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A Weekly Review of Current Electricity

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Vol. VIII. NEW YORK, JULY 17, 1886. No. 3.

THE good people of Evansville and other places in Indiana equal in intelligence, have discovered a new way of cutting off their noses to spite their faces. They have not only deprived themselves of telephone service, but to prevent any restoration of it have hewn down the wires and poles.

THE proposition to give the police force of this city a good telephone system of its own, and at the same time bring the public exchange system into direct connection, for each subscriber, with police headquarters, is a good one. The plan if adopted will be a move in the right direction, especially as the city is not committed to a greater outlay than is now incurred under the old system, which, with all its merits, cannot compare with the telephone for promptness and efficiency.

ELECTRO-THERAPEUTICS command more attention to-day than ever. The period of quackery in the application of electricity in medicine has drawn to a close, and the interest taken by physicians and surgeons in the subject has grown rapidly. Mr. August Partz gives in our columns to-day an interesting summary of the early history of electro-therapeutics, showing how old are some of the most advanced ideas. We agree with him, that it was a merciful interposition of Providence that saved science from the use of the word "swammerdamism," in place of "galvanism."

MR. D B. MACQUARRIE, to whose facile pen we have recently been indebted for a number of able and interesting articles, gives in this issue a description of the Kansas City telephone exchange, of which he is manager. His article is full of suggestive points; and while most of the details will be familiar to telephonists, it is not often that so full and comprehensive an account is obtainable of any one exchange system. We are glad to note the telephonic growth of Kansas City, but we cannot help thinking that the exchange does too much work. The number of connections is too high in comparison with the figures returned by other large systems.

HE would have been looked upon as a visionary who would have predicted a short time since that the gas battery might soon enter the field as a new competitor with the numerous forms of electric generators already in existence. Yet the description of a recently-devised gas battery which we give on another page shows that what may be matter of speculation one day can easily be a matter of fact the next. While the apparatus exhibits considerable ingenuity in its details, and is said to operate for long intervals without attention, it remains to be seen whether it possesses sufficient advantage to displace other and older forms of electric generators.

IN this week's continuation of the latest researches on self-induction, Professor Hughes draws attention to the property the telephone has of singling out from a number of complex vibrations those corresponding to the rate of vibration of its own diaphragm. It will be remembered that Professor Bell, in his patent, which we reproduced in our issue of May 29, describes this same quality of the telephone; and, indeed, the patent No. 186,787 is based entirely upon this peculiar behavior of the diaphragm. So far as we are aware, this action exhibited by the telephone has not been put to any practical work; but the ingenious harmonic telegraph of Elisha Gray resembles it very much in principle.

AN item in another column describes rather indefinitely an "electrical machine for locating articles lost overboard," the presence of metal, such as iron, steel, gold and silver being readily detected by the "rapid revolution of a compass needle." Probably many of our readers would be able, upon short reflection, to devise several forms of apparatus for the same purpose, numerous phenomena being available for such an application. The "rapid revolution" of the compass needle is probably the simple deflection of a galvanometer needle influenced by the closing of an electric circuit. The induction balance might be used for such a purpose, distinguishing even between the different kinds of metals.

TRAMCARS deriving their power from storage batteries carried upon them are growing in favor. We have recently had occasion to chronicle their employment in an English colliery upon mine locomotives, and we now hear of their successful application to a tramway in Hamburg, Germany. At Antwerp, where such an electric car came off victorious in competition with other means of locomotion, quite a number are now in daily operation, and Berlin is making preparations for their introduction on an extended scale. The near future will see some attempt made for their application in a similar manner in this country, the ease with which they can be adapted to existing conditions being greatly in their favor.

WE have already drawn attention to the results of Professor Hughes' latest researches proving the superiority of copper over iron and steel for telegraphic and telephonic purposes; but we recur to the subject to draw attention to the remarkable difference in the relative self-inductive capacities of compound wires of the same metal, but differently arranged with respect to one another. Thus it is shown, in another column, that a compound wire having a steel core and an outer layer of copper is nearly as free from self-induction as one of copper. But, on the other hand, a compound wire having a solid core of copper with an outer layer of steel possesses greatly increased self-inductive capacity, and hence is less suitable for the above purposes. We may find an explanation of this phenomenon in considering that the copper shield acts in the capacity of a "damper," in which currents are created which decrease the effect of the circular magnetism of the steel core. With the copper on the interior of the wire, such action cannot take place, and hence the increased effect observed.

ONE of the most curious and interesting episodes in recent telegraphic history is that in which the president of the Western Union Company figures, as described by himself in a letter quoted in our columns to-day. The public is not informed as to the nature of the negotiations, but we find the dignified representative of the great corporation waiting at "Ed." Stokes' gilded palace to see that gentleman and Mr. Mackay. But, says the worthy doctor: "When I began to ponder what I was to see them about or what I had to say to them, I could not resist the conclusion that I was on a fool's errand, and did not send up my name." So graphic is the picture thus presented that one can easily see the Western Union president sitting, solitary and perplexed, amid the splendors of the Hoffman House parlors, and then, untempted even by the seductions of the adjacent combination of picture gallery and bar-room, suddenly making up his mind not to have any more dealings with Stokes and his "backer," and going home in silence and in thoughtful mood to Twenty-third street. Suppose Dr. Green had sent up his name!

THE result of the great suit of Receiver Farnsworth against the Western Union Company for $2,000,000 for damage inflicted on the Bankers & Merchants' lines last July must be regarded as a moral triumph, and one pleasing to all who believe that law and property are entitled to respect. The verdict has shown that it is not safe even for the strongest and most reckless corporation to destroy the property of a competitor. Mr. Conkling in one part of his fine summing up argued in all reasonableness that had such a destruction of telegraph lines been carried out by Herr Most or Mr. Powderly as was instigated and made by Western Union officers, the press would have rung with denunciations of such rascality. In fact, Mr. Powderly would not have sanctioned any such act of vandalism as was cheered on a year ago by those whose vested interests should have made them above all others the conservators of rights and of property. The question is not one of the competitions of telegraph companies, nor one as to the personal rivalries of Mr. Gould and Mr. Stokes. It concerns the wider and more important matter of public welfare and safety, and therefore the verdict is one all must rejoice in.

Several cases have recently been reported in which lightning, having struck the water mains of towns, caused their destruction in parts. The latest of these occurrences took place in Halifax, N. S., where lightning struck a fire hydrant, and, notwithstanding the easy path to ground which the mains apparently afforded, tore up the length of two blocks, throwing large rocks to the surface. A contemporary, in commenting on this fact, states that this is contradictory of the advice of lightning experts, who tell the public to carry the rods down to connect with the water mains. We are not aware that "experts" give this advice. It is undoubtedly true that recent experience has shown the practice to be dangerous. Lightning is so powerful and rapid in its action that the rupture of water pipes must be expected when they are struck. It may be possible, however, to assign another cause to the rupture of water pipes, and that is the sudden evolution of steam caused by the heat of the electric spark. While probably no large amount of steam would be generated by a lightning stroke, its sudden generation and close confinement might create sufficient pressure to burst the pipes and cause the results which have recently been observed. It would, therefore, seem advisable always to look for other means of grounding lightning rods and to relegate the water pipes to the conduction of currents of low potential.

THE successful commercial accomplishment of converting heat into electrical energy without the medium of the boiler, steam engine and dynamo, may be said to be the philosopher's stone for which many at the present time are in search. Heat, it is true, can be converted directly into electricity in the thermo-pile, but although this form of apparatus is undergoing steady improvement, it is as yet debarred from active competition with other forms of electric generators. We describe this week, however, a most interesting method of applying heat for the production of electricity. It differs from the thermo-pile in the fact that the conversion is not direct, but is effected through the intermediary of chemical action. As regards the number of conversions, therefore, it comes in the same category as the production of electricity by the dynamo; for in the case described we have heat converted into chemical energy, which is finally converted into electrical energy. In the case of the dynamo, we have the sequence, heat, mechanical energy and electrical energy. In the absence of any record of tests made with this form of apparatus, its efficiency as an electrical generator can only be conjectured. Although involving chemical action similar to that in ordinary galvanic batteries, the apparatus operates without the expenditure of material within it, and it may in one sense, perhaps, legitimately be classed under the head of heat energies; indeed, it approximates in its action very closely to the ordinary form of hot-air engine, such as Ericsson's. In both forms the communication of heat produces a change in a body which is brought back to its original condition by the abstraction of the heat, when it is ready for another similar cycle of operations. The method as described is quite ingenious, and we hope to see it developed more fully.

The Dawn of Electro-Therapeutics.

BY AUGUST PARTZ.

The application of electricity as a healing agent dates back to the middle of the last century, and Jallabert, of Geneva, appears to have been the first who performed some cures by its means. In his *Expériences sur l'Electricité*, published in 1748, he describes more or less successful treatments of cases of paralysis, of tumors, chilblain, suppression of the menses, etc., by frictional electricity. As early as 1746 the Abbé Nollet had, in his *Essai sur l'Electricité des Corps*, related experiments made by himself and two physicians on paralytics, but no decisive results had been attained. The method employed by Gallabert and adopted by most of his followers consisted in insulating and electrifying the patient, and drawing sparks from the diseased parts of the body. Physicians and scientists nearly all over Europe soon became interested in the announced remedial property of a force which was already a favorite object of investigation. There was much experimenting, mostly based on erroneous hypotheses; but, from a mass of corroborative testimony, it cannot be doubted that also many cures and ameliorations were achieved, principally of maladies of a paralytic nature. (Note 1.) A great number of books and essays were written on the subject by Mauduit, de Haen, Wesley, de Saussure, Sigaud de la Fond, Abbé Bertholon, Zetzel, Wilson, Hiotberg, Adam, Levet, Verrati, Abbé Sans, Duboueix, Mazard de Cazelles, and many others, and in 1782 the experiences and theoretical deductions published till then, were ably reviewed by Bonnefoy, of Lyons, in his *De l'Application de l'Electricité à l'Art de Guérir*. The essence of this book is contained in the following paragraph from its closing chapter:

"As physiologist, I have seen the electric fluid manifesting its existence in man and animals by the shock, the spark, the phosphoric light; passing from the atmosphere into the lungs, from that organ to the brain, whence, being transformed into nervous fluid, it is conveyed through the whole system, to execute therein its functions. As physician, I have beheld the effects of electricity upon the animal economy; it accelerates the circulation, renders the secretions more abundant, augments the animal heat, stimulates the muscular movements; more in general, it quickens the flow of the liquids and heightens the irritability of the solids."

Toward the end of the century the interest in electrostatic therapeutics somewhat subsided, probably because the primitive contrivances commonly employed for generating electricity were too inconvenient and inefficient, and although the old glass globe machine had already been superseded by the disc machines of Ramsden (1768) and Van Marum (1780), and the cylinder machine of Nairne (1782), these improved machines were very costly, and in the possession of only a few scientists and institutes. (Note 2.)

The discovery of galvanism in 1780 soon absorbed the attention of persons interested in electrical phenomena, and turned their labors into a new channel. (Note 3.) However, the medical application of frictional electricity was never entirely abandoned, and it received a fresh impulse through its introduction in 1837 at Guy's Hospital in London, where many remarkable cures, chiefly of chorea and paralytic affections, have since been made by its means, and made in the same way in which Jallabert treated those maladies nearly a century before.

Though Galvani had already expressed some ideas regarding the use of the kind of electricity which bears his name for remedial purposes, he did not carry them into practice; and the honor of having taken the initiative in this matter, and pursued it experimentally, belongs to his nephew and pupil, Aldini, who narrates, in his *Essai Théoretique et Expérimental sur le Galvanism*, *Paris*, 1804, many curious facts regarding the physiological effects of electricity, and numerous pathologic cases in which he had applied it. Of the subsequent development of galvano-therapeutics, and the eventual accession of faradic electricity to that branch of medical science, an elaborate review may be found in the third volume of De la Rieve's *Treatise on Electricity*.

Notes.

1. A curious "medicine," contrived by Pivati, of Venice, is mentioned in Abbé Nollet's *Recherches sur les Causes Particulières des Phénomènes Électriques*, Paris, 1750. A tube or globe of glass was filled with drugs, hermetically closed, electrified, and applied to the patient. The essences of the drugs were supposed to penetrate the glass at each electric discharge, and not only are a number of cures of sciatica, paralysis, etc., cited as well authenticated, but there also were persons who could smell certain drugs through the glass.

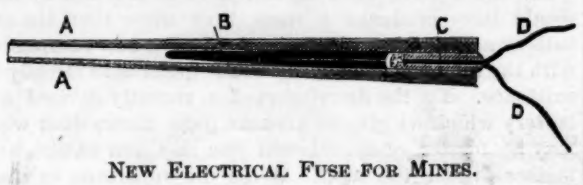
2. The invention of the glass globe machine is often attributed to Franklin, who began his electrical investigations in 1747; but already about the year 1709 the English physicist Hawksbee made a machine in which he substituted for Otto von Guericke's globe of sulphur one of glass, and which could be rotated at an accelerated speed by means of a crank and a pair of transmission wheels. Hawksbee's machine is shown in Priestley's "History of Electricity" and in Figuier's excellent work, *Les Merveilles de la Science*.

3. In a book published by Swammerdam toward the end of the seventeenth century, under the title *Biblia Naturæ*, the author relates the following experiment made by him in 1678, before the Grand Duke of Tuscany. To a nerve projecting from a muscle placed in a glass tube was fastened one end of a fine silver wire, while the other end was attached to a piece of copper shaped, and inserted in the tube, in such a manner that the wire passed freely between it and the glass. When the nerve was drawn up so as to touch the copper, the muscle immediately contracted. This was substantially what Galvani did one hundred years later. It must have been through a kind providential intervention that we did not get "Swammerdamism" instead of Galvanism.

New Electric Fuses for the Ignition of Mines.

The ignition of mines charged with ordinary powder or dynamite—write MM. Scola and Ruggieri, in *Comptes Rendus*—presents numerous difficulties and dangers which might be entirely avoided by the use of our new electric fuses.

These fuses are composed of two copper wires *D D*, covered with cotton and coiled on a small wooden cylinder *C*.

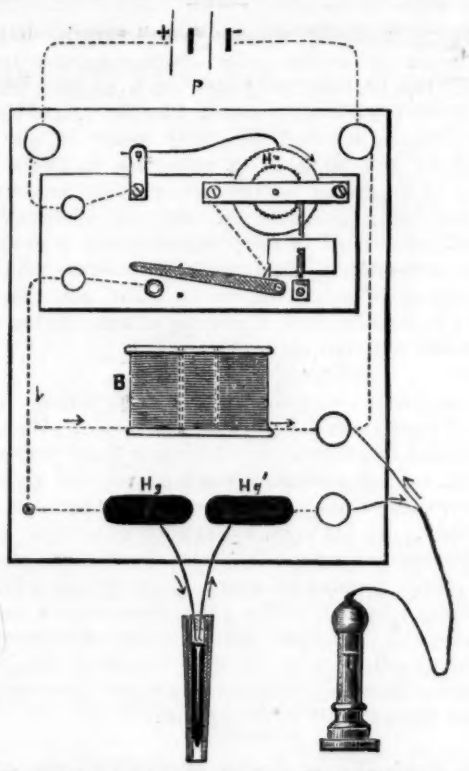


NEW ELECTRICAL FUSE FOR MINES.

Round these wires and their support is glued a paper cartridge filled with a priming composed of chlorate of potash, saltpetre, sulphuret of antimony, and retort charcoal in fine powder; the last-mentioned ingredient serves to give a slight conductivity to the mass.

The wires thus arranged are fixed at the extremity of a paper tube *A A*, which contains a port-fire or a powder-match *B*.

If we wish to effect the explosion of a mine charged with common powder, we reserve in the mass a narrow, empty cylindrical space by means of a pin. The fuse described is placed at the upper part of this channel. It is merely necessary to connect the two wires to an induction coil, or, preferably, to the ingenious apparatus known as a "coup de poing," to obtain at the desired moment an extra-current spark which ignites the fuse-paste. The gases produced in this combustion ignite the match, and



TELEPHONIC APPARATUS FOR FUSE TESTING.

project it with great velocity into the middle of the mine.

If we use dynamite, we add a fulminating primer, upon which the match impinges at the instant of its projection.

The use of our new fuses secures the ignition of mines, prevents any accident which might result from their hanging fire, and will, we hope, render excellent services in numerous branches of industry.

Apparatus for Verifying the Manufacture of Electric Fuses.

In the manufacture of electric fuses for igniting mines—remarks M. Ducretet in *Comptes Rendus*—it has been found to be advisable to ascertain beforehand, by a rapid process, the quality of such fuses, so as to set aside all those which are not certain to act.

To arrive at this result, the fuses must be constructed in such a manner that the extra-current spark of the electric apparatus may strike with certainty in the midst of the composition of the fuse. We must, therefore, ascertain:—1. That the two copper wires are not in metallic contact, which would happen if the protective covering were removed. 2. That the two wires are still so near each other that the spark may strike between them.

These conditions, apparently very delicate, may still be verified in the most complete manner by means of an apparatus which I have constructed. This apparatus consists of a battery *P* of three Leclanché elements, the current of which traverses an interrupter *H*, with a clock-work movement, then a bobbin of fine wire *B*, and ends in two small cups of mercury *H g* and *H g'*.

Lastly, a telephone *T* is placed on the circuit in derivation.

When the interrupter is set in motion, and one of the wires of the fuse is plunged into each of the small cups, there is observed in the telephone an unbearable noise, if there is metallic contact between the copper wires. If, on the contrary, the two wires are absolutely insulated, the telephone remains silent; and, lastly, if the fuse is of good quality, we perceive a slight crackling, resulting from the passage of the electricity through the material of the fuse, which contains a large proportion of retort-carbon.

In the last case only the fuse is recognized as of good quality, and we may feel assured that it will certainly ignite.

With this apparatus, therefore, we can in a very short time verify a large number of fuses, the resistance of which is higher than a million ohms, and be assured of their quality.

The New Laboratory at Johns Hopkins University.

Among the facilities lately acquired by Johns Hopkins University, Baltimore, is a fine new laboratory, equipped with the newest apparatus, selected with reference to investigations that will be made, and specially valuable for researches in electricity, magnetism, light, and heat. The building consists of four stories and basement, is 115 × 70 feet, and is of red brick, with brown-stone trimmings. The first floor is occupied by a large lecture hall and rooms for advanced work in electricity and heat. On the second floor are mathematical lecture rooms, studies for instructors, and a room for the mathematical and physical library of the University. On the third floor is placed the elementary laboratory, and the fourth floor will be fully equipped for photographic work on the spectrum or on other physical phenomena, and for special investigations in light. The tower of the building is a convenient observatory for ordinary work, and is provided with telescope and dome. A power plant will be installed for driving the machinery in the workshop, and for energizing the dynamos, which will be situated at some distance from the laboratories.

It is noticeable that special pains have been taken to preserve the electrical apparatus from all magnetic disturbance. Thus the section containing the electrical laboratories is entirely free from iron, with such refinement of detail, in fact, that the sash weights are of lead and the gas pipes of brass. Moreover, peculiar care is taken to obtain steadiness for galvanometers and the like. The building will be in readiness by the early autumn.

For students who desire to make a special study of physics, beyond an elementary course, an advanced course is laid down, comprising lectures and laboratory work. The lectures include four weekly by Prof. Rowland on electricity and magnetism, developing fully in the second year the mathematical treatment of thermo-dynamics, heat conduction and physical optics. But beside this, there is a special and important course in electricity and magnetism, extending through two years, under the immediate supervision of Dr. Louis Duncan, whose name is so familiar in connection with the Franklin Institute tests of 1884-5. The new laboratory affords great facilities for the successful carrying out of this new work. The lectures for the first year are intended to give the student clear physical ideas of general principles, with such mathematical interpretation as is necessary to enforce and apply them. Besides the lectures there will be a weekly meeting for the purpose of discussing articles of interest appearing in the different electrical journals. The laboratory work will include measurements of resistance, current, potential, capacity, etc., with voltameter and calorimeter work, and the student will be familiarized with the instruments for electrical measurements, galvanometers, dynamometers, resistance coils, Wheatstone bridges, condensers, etc. Toward the last of the year each member of the class will be given some experiment, bringing in the use of the methods he has already studied. Besides the special course in electricity, the student will take the lectures in mathematics required to fit him for the second year's work, with such other subjects as he may select—chemistry, drawing, modern languages, etc.

In the second year those parts of the theory more directly involved in the practical application of electricity will be further treated, and the theory of dynamos, motors, storage batteries, the transmission and distribution of energy, the telegraph, telephone, etc., will be given. As in the first year's course, there will be weekly meetings for the discussion of the newest developments of the subject. The laboratory work will include the tests and running of dynamos and motors, the efficiency and practical working of storage batteries, photometer work, testing of telegraph lines, laying wires under ground, experiments on the electrical transmission of energy, telephone work, etc.

Sufficient time will be given for selected courses outside of the special work sketched above. Beside the course in electricity the student will be required to take the regular second year's undergraduate course in general physics or its equivalent. At the end of the course, on passing the necessary examinations, the student will be given a certificate, stating that he has taken the special course in electricity at the Johns Hopkins University and passed the required examinations.

The "Upward" Gas Battery for Domestic Lighting.

A decided new departure from the well-worn groove in which experimenters on primary batteries have hitherto worked, is a novelty which is deserving of more than a passing notice. The new battery, which is the invention of Mr. Upward, the head electrician to the Woodhouse & Rawson Electric Manufacturing Company, occupies an intermediate position between the gas battery of Grove and the ordinary primary element. The energetic action of chlorine in a gas battery was pointed out by Grove, and it seems probable that this fact has been a suggestion

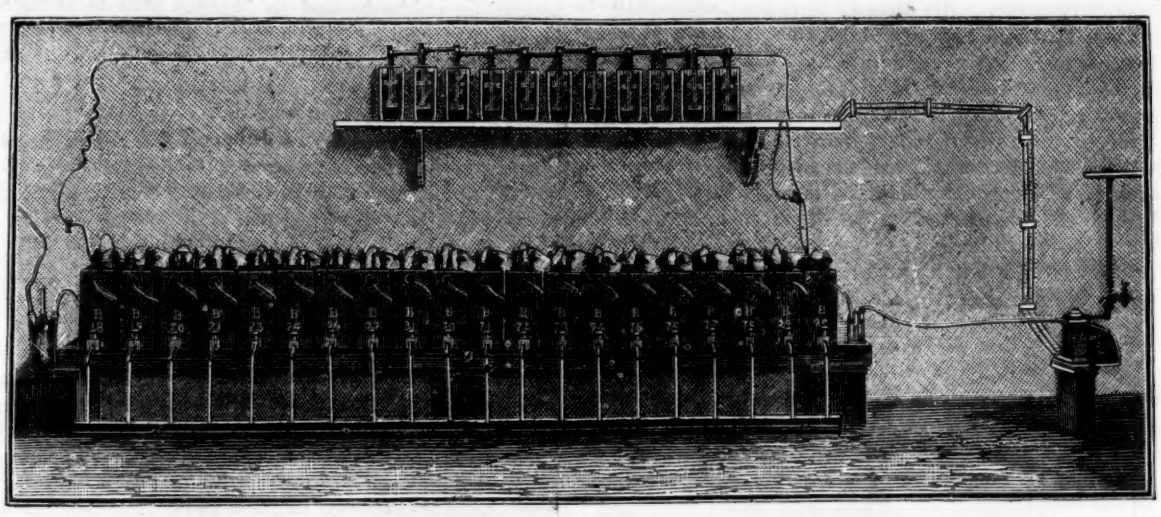


FIG. 1.—A BATTERY OF "UPWARD" GAS CELLS.

to the inventor of the new battery. Briefly speaking, the construction of the latter is as follows: The elements are the ordinary carbon and zinc, or carbon and iron, and the battery is maintained in active condition by the passage of chlorine gas through the cells. Each cell consists of an outer and inner vessel; the outer one, which is of glazed earthenware, is provided with air-tight inlet and outlet pipes, while the inner vessel is an ordinary porous pot. Between these two vessels the carbon plates are placed, and tightly packed in with crushed carbon; cement is then used to seal the top of this outer chamber. In working the battery the most ordinary commercial zinc cast into blocks, and without any amalgamation, is placed in the inner cell, which is then filled up with plain water. Chlorine gas, which may be obtained from common chloride of lime, is then admitted to the outer or sealed chamber, and circulates from cell to cell through

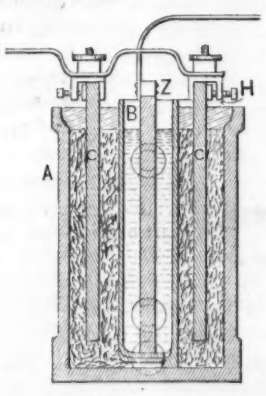


FIG. 2.

the whole system. The pressure inside the cells being less than atmospheric pressure, there can be no leaking of the gas.

In order to supply the cells with a constant flow of chlorine, a simple gas holder, working on the displacement principle, is used, chlorine being two-and-a-half times the weight of air. This gas holder, which has no moving parts or valves of any kind whatever, is capable of holding sufficient to work the battery without interruption, even although the gas may be generated at intervals.

Fig. 1 shows a battery of 20 cells, which, according to the London *Electrical Review*, has been at work for the last six months in the works of the Woodhouse & Rawson Electric Manufacturing Company, and which requires absolutely no attention whatever, except the weekly addition of water to the zinc cells to make up for what has percolated through the porous pots into the outer cells. The zinc plates which were recently replaced, had by constant use been reduced to the thinness of a wafer, and the renewal only occupied one man between 30 and 40 minutes.

In Figs. 2 and 3, which are a section and side elevation of a single cell, *A* is the outside glazed earthenware cell; *B*, the porous pot; *C*, *C*, the two carbon plates, surrounded by crushed gas retort carbon, and sealed with cement at *H*; *Z*, the zinc plate; *D*, the gas inlet to outer cell; *E*, the gas outlet; *T*, earthenware tap, connected to a glass tube *F*, which dips in the trough *G*. The trough is constantly full of zinc chloride, which has drained out of the carbon cells. The dimensions of these particular cells are 11½ inches × 5½ inches and 12½ inches deep.

The zinc chloride solution which is formed by the working of the battery, very slowly percolates through the porous pot *B*, into the outer cell and insures the broken carbon remaining moist; but the tap *T*, which is always open, prevents any liquid accumulating in the outer cell, allowing it to run down *F*, into the trough below. The level of the liquid in this is always kept above the orifice of the tubes, so that no gas escapes, while an overflow is provided into the house drain (chloride of zinc is an excellent disinfectant). The method of supplying the cells with chlorine gas is highly ingenious. The gas arrives from the holders, described below, by the tube seen at the left of Fig. 1, where it passes into a bubbling bottle, from which it enters the lower part of the first cell (*B* 18); the exit at the upper part of this cell is connected by a tube to the inlet at the lower part of the second cell, and so on through all the cells in series; the exit of the last cell being connected by a tube, through another bubbling bottle, to a simple water aspirator or ejector, shown at *O*, Fig. 4.

Assuming the cells to be all full of gas and the circuit closed, the gas will be equally consumed in every cell in proportion to the current; and, as the carbon cells are hermetically sealed, a vacuum is gradually produced, thus drawing further supplies of gas from the holder. If the chlorine were absolutely pure no further feeding would ever be required, as the cells would always keep themselves supplied from the holder.

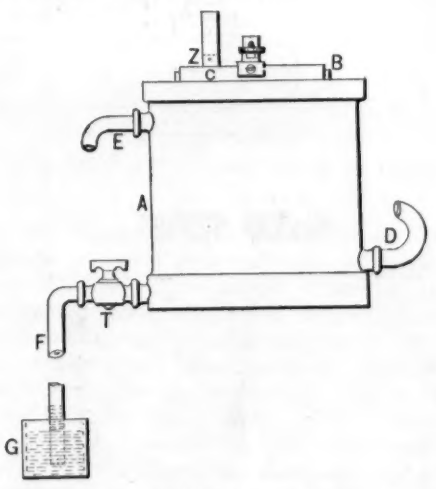


FIG. 3.

In practice, however, it is not possible to prevent the admixture of a small quantity of air (say 3 per cent.), and a consideration of the conditions will show that this air must first accumulate in the last cell.

The E. M. F. of this last, or right-hand cell will, therefore, drop before that of the others is in the slightest degree affected, and this drop is arranged to open the aspirator automatically by means of the apparatus shown in Figs. 4, 5 and 6, and to cause the removal of this accumulated air.

The terminals of the last cell are joined to the terminals of a high resistance magnet *A*, which, when the E. M. F. of this cell is normal, has sufficient power to pull down its polarized armature *D*, and the course of the main current from the battery is from the last cell through the mercury cup *C*, armature *D*, and pillar *E*, to the outer circuit; but when the E. M. F. of this last and master cell falls by reason of accumulated air the armature is released, and contact broken at *C*, so that the main current has to pass round the large electro-magnet *H* to the outer circuit. The armature *J* of this magnet is then attracted and opens the ball-valve *L*, which is normally kept closed by the spring *K*. Water then enters the aspirator *O*, drawing off the air from the last cell through the tube *P*. As soon as the air is replaced by chlorine the E. M. F. of the cell rises again, the armature *D* is attracted, the large magnet short-circuited, and the armature *J* released, so that the water supply and action of the aspirator is stopped.

When the battery is in regular use the aspirator "goes on" for about 30 seconds, at intervals of from one to three hours, according to the purity of the gas. The quantity of water used is, therefore, infinitesimal, and there is absolutely no waste either of water or gas.

The form of gas holder which has been adopted after

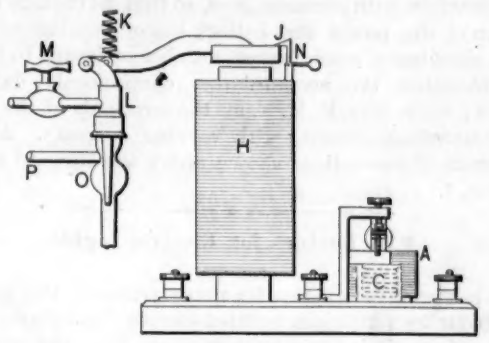


FIG. 4.

much experiment with mechanical and liquid sealed holders consists of several columns made of ordinary earthenware drain pipes cemented together and tarred on the outside.

The chlorine gas from the generator, which is two and a half times as heavy as air, enters the first column by a tube at the lower end, displaces the air and overflows through a lead tube to the bottom of the second column, which also becomes filled from the bottom upwards; the third and succeeding columns then fill in the same way, the number employed depending on the amount of gas it is desired to store, each column of four 9-inch diameter drain pipes holding gas equivalent to about 460 watt-hours. Each of the lead tubes connecting the columns is provided with a glass bulb painted white at the back, which enables one to see at once how many columns are filled with gas, as the well-defined color of the chlorine shows up distinctly against the white background. The last column is provided

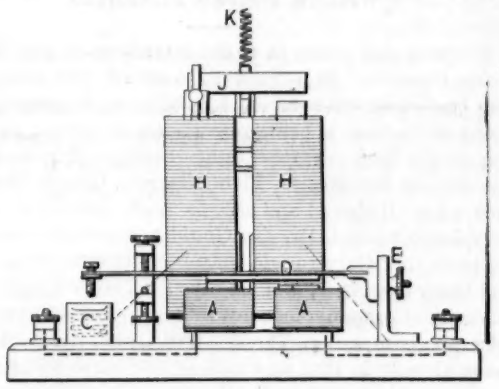


FIG. 5.

at its top end with an outlet tube carried into the outer air.

Up to the present time the manufacture of chlorine gas has been distinctly an operation to be carried on out of doors, and Mr. Upward fully recognized that unless the gas could be easily produced in a perfectly inodorous manner its use for household purposes would be impracticable.

The method adopted is said to be free from any objection on this score, the whole operation being perfectly free from smell and extremely simple, so that a servant can do all that is required. The generator consists of a round outer earthenware pan, 18 inches diameter by 12 inches deep, permanently set in a sand bath, which is heated by a small gas jet or small oil flame; the quantity used of such fuel being extremely small. In this outer jar is placed a perforated earthenware vessel, containing a month's charge of manganese, the whole being closed by a cover with a water seal, which makes the generator absolutely gas-tight. In the cover is a funnel, provided

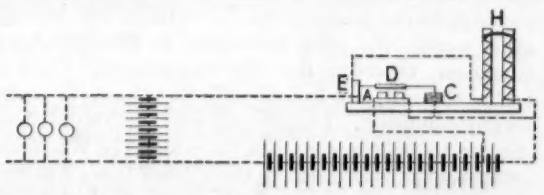


FIG. 6.

with a tap, and when it is required to make gas, the funnel is filled from a vessel containing concentrated brine and from another containing dilute sulphuric acid, and the tap being turned, the contents pass into the generator.

The chlorine generated is led away through a hole in the cover to a bubbling bottle and then to the holder, a branch tube being taken off to the batteries. At the bottom of the outer pan is a tap and pipe to the drain, for emptying the liquid when spent. When the charge of manganese has become exhausted by constant repetition of the above process, the pan is filled, through the funnel, with water, so as to wash it and expel the least trace of

gas. The water is then run off, the cover lifted, and the perforated vessel refilled with fresh peroxide of manganese. The replacing of the cover then renders the apparatus fit for further generation of gas. The small size cells shown in the accompanying illustration, Fig. 1, have each an internal resistance of .2 ohms. They can, of course, be made of any desired internal resistance, and there is a large one at the works of Woodhouse & Rawson, which gives 150 ampères on short circuit.

It is intended that the battery shall generally be used in conjunction with accumulators, so that advantage can be taken of the power the battery has of continuous working, allowing a much larger number of lamps to be run by charging the accumulators continuously day and night; while the E. M. F. at the terminals of the lamps is maintained constant with varying currents. A set of 11 accumulator cells is shown above the Upward battery in Fig. 1.

Mill Engines for Electric Lights.

It has been the custom for many years of the mills in this country putting in isolated electric light plants to use power from their large mill engine. This has not been always successful. In Fall River, where everything is figured down pretty close, it was found that the extra cost of running the large Corliss engine fifteen minutes before starting up the looms in the morning and fifteen minutes longer at night for the help to go out in the evening of winter days was costing too much. Again, where incandescent lamps were used, the pause of the engine shaft when going over the centre showed itself in each stroke, giving as many flickers per minute as revolutions were made by the engine. A mill in Rhode Island, where the main power used was a Corliss engine, recently found another advantageous employment for its electric light engine. The Corliss engine was disabled, and while being repaired the management ran what machinery they could by a $9\frac{1}{2} \times 12$ Armington & Sims Company's engine (rated 50 horse-power), making 300 revolutions. They ran the steam up to 120 lbs. pressure and by indication found the engine was developing 110 horse-power.

Western Union's Intentions.

Rumor is still active as to the intentions of the Western Union Company in regard to meeting the competition that has become so severe. It is believed in some quarters that a settlement is being negotiated of either the cable war or the land telegraph fight—perhaps of both, and it is pointed out that Messrs. Field, Garrett, George Gould and Stokes are all abroad and able to meet quietly in London. On the other hand, Mr. Jay Gould has denied these stories. He hints that the struggle may become even more intense and bitter than it is, and he says: "The Western Union Telegraph Company does not intend to buy any more rival telegraph companies. The Western Union has paid enough taxes already in that way and is now quite willing to let some one else pay them." Mr. Gould stated in an interview that Col. R. G. Ingersoll had offered to sell the United Lines property for $1,200,000, in 5 per cent bonds, including the Farnsworth suit. Col. Ingersoll denies the story "most emphatically." He says:

"I never offered the United Lines property and the 'lawsuit' to Mr. Gould or to the Western Union, nor to anybody else, for $1,200,000 in five per cent. bonds, nor for any other sum at any time or place. No such offer was ever made by me. I was never authorized to make any such offer, and such an offer was never made. In fact, I never spoke to Mr. Gould about the suit of Farnsworth vs. the Western Union, but I was offered what amounted to $50,000 a year by an attorney of the Western Union to have the 'lawsuit' postponed. The attorney stated that if we would continue the lawsuit until the suit of Harland vs. Farnsworth, pending in the Federal Court, was decided, saying at the same time that it would last about four years, he would give us the rent on the strung wires—amounting to about $20,000 a year—give us two wires from Hartford to Boston, two wires without rent from Albany to Utica and some other privileges, amounting in all to about $50,000 a year, all this for a simple continuance without prejudice to the rights of the plaintiff. In other words, the offer amounted to $200,000 for a continuance. Of course the offer was refused. I had no control of the suit, and had no right to adjourn or postpone it on any condition. I hardly see why Mr. Gould should endeavor to belittle a lawsuit for which the Western Union offered what was worth to the United Lines $50,000 a year for a postponement until the suit of Harland against Farnsworth in the United States Court should be decided, stating at the same time that that case would last about four years. Mr. Gould made an offer for some of the securities of the United Lines owned by Mr. Stokes, and the offer was refused. That is all there was to it."

To show that approaches were made by the other side, Col. Ingersoll has published a letter addressed by Dr. Norvin Green to Mr. George H. Pell, as follows:

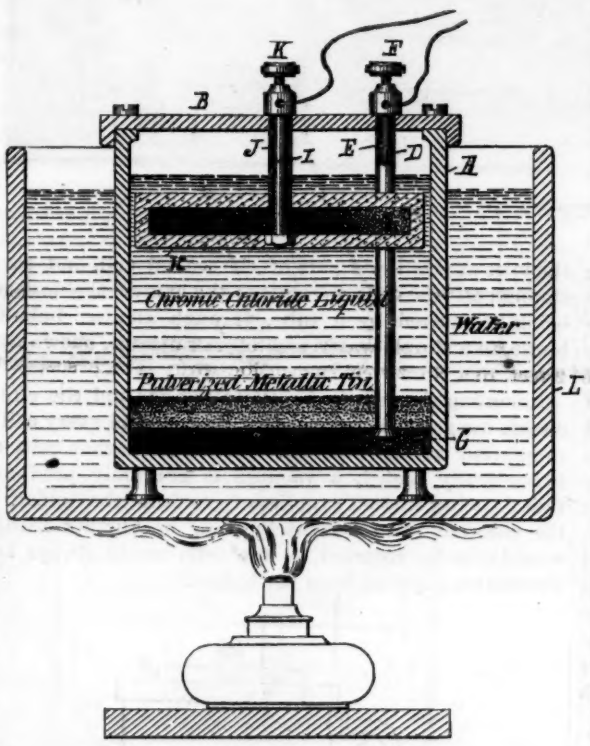
"DEAR SIR—I was at the Hoffman House last evening at half-past eight o'clock, for the purpose of seeing Mr. Stokes and Mr. Mackay. When I began to ponder what I was to see them about, or what I had to say to them, I could not resist the conclusion that I was on a fool's errand, and did not send up my name. I am prepared to talk business with those gentlemen when they have anything definite to propose; but the steps being taken by them are so inconsistent with our former talk that they appear to render impossible all that was proposed."

As the result of all this talk and newspaper publicity, Western Union stock has been unusually active. It advanced several points a day, but has now fallen back near 60 again, not, however, it is said, before some of the executive officials were able to dispose freely of their "long" stock. It may be added that the Baltimore & Ohio and Commercial Cable officials have also pronounced the stories about negotiations as false, thus helping the decline in prices of Western Union.

A New Method of Converting Heat into Electrical Energy.

The problem of converting heat into electrical energy in an economical manner has long occupied the attention of electricians and inventors, and the prediction has already gone forth that we shall see a time when electricity will be produced commercially, directly from coal, without the intermediary steam engine and dynamo. The well-known thermo-pile, it is true, converts heat energy directly into electricity, but thus far this class of apparatus has not gone beyond a limited use in the laboratory.

Recently, however, Mr. Willard E. Case, of Auburn, N. Y., has devised a method of utilizing heat for the production of electricity, and he accomplishes his object through the intermediation of chemical energy; but, as will be seen presently, his method differs in principle from that of the usual galvanic cell, in which chemical energy is converted into electricity. In Mr. Willard's apparatus, despite the formation of a circuit and the placing together of the ingredients, no chemical reaction occurs and no current is produced; but when heat is applied chemical energy is developed in the apparatus and the electrical current is generated; hence the chemical energy engendered corresponds and is correlated to the heat energy supplied, and the electrical energy, depending on the chemical energy, through that medium is in like manner correspondent and correlative.



CONVERTER OF HEAT ENERGY INTO ELECTRICAL CURRENT.

In order to maintain the development of chemical energy, the supply of heat energy must be maintained: but the limit of development of chemical energy is found when the affinities of the elements rendered free to react by the heat are satisfied. Then the apparatus becomes inert and substantially like that of a zinc-carbon galvanic cell when all the zinc has been converted into sulphate.

Mr. Case has discovered that when the apparatus has reached this stage it can be brought back to its original potential state by merely allowing it to become cool, or, in other words, by abstracting the heat imparted to it. For the ingredients on cooling develop new affinities, and the consequence is a reaction, which brings the apparatus back to its original state.

The apparatus employed for the purpose is shown in section in the accompanying illustration. It consists of a vessel *A* closed hermetically by a cover *B*, and a plate *C* of carbon, which rests on the bottom of the vessel. Connected with the carbon plate is a rod *D* of conducting material, covered with an insulating material *E*. This rod extends through the cover and communicates with a binding post *F*, to which one of the circuit wires is attached. Upon the plate *C* there is placed a quantity of pulverized metallic tin, which makes electrical connection with the plate.

Another carbon plate *G* is surrounded with an envelope *H* of porous non-conducting material, such as baked clay or pottery. This plate *G* is connected to an insulated rod *I*, which passes through the core, and is connected to binding-post *K* from the terminal of the other circuit wire.

In the vessel *A* there is placed a solution of chromic chloride, which is prepared by the well-known process of heating together chromic acid, hydrochloric acid and alcohol.

Thus constructed and with pure materials the apparatus yields no current at normal temperature; but upon applying heat to the vessel and raising the temperature of the liquid, a current becomes manifest. In order, however, to prevent the temperature rising above 212°, which is found to be ample, the vessel *A* is placed in an open tank *L* filled with water.

Mr. Case, who has recently patented his apparatus, explains the operation of the battery by the fact that the elevation of the temperature decomposes the chromic chloride in the presence of the tin into free chlorine and chromium protochloride. The chlorine then combines with the pulverized metallic tin to form tin protochloride, and as a consequence of this reaction an electrical current is established through the liquid and between the metallic tin as one electrode and the carbon plate *G* as the other electrode. The carbon plate *C* is not itself an electrode, but serves simply as a conductor in contact with the tin to lead the current to the circuit terminal. The heat being maintained, the current continues to flow until all the tin is converted into protochloride. The apparatus is then spent or exhausted, all chemical affinities rendered active by the application of heat being satisfied, and the current ceases.

As the liquid cools, the tin protochloride and chromium protochloride react. The chlorine from the tin protochloride goes over to the chromium protochloride, forming chromic chloride, and metallic tin is deposited. This tin falls by gravity upon the carbon plate *C*, and by the time the liquid has been cooled down to normal temperature the condition of the apparatus is the same as it was in the beginning, so that it is simply necessary again to apply heat to cause a current to be generated. The object of the porous non-conducting envelope around the carbon plate *G* is only to prevent any possible deposition of tin thereon.

It will be seen from the foregoing that it is not necessary, in order to maintain the apparatus as a producer of electricity, to replenish the contents, but that all that is required is to heat the apparatus, as above described, to cause it to yield a current, then when the current ceases, to cool it, and then to reapply the heat, and so on indefinitely.

International Wire Gauge.

Below are two additional letters on the subject of the adoption of the new British standard wire gauge:

THE CONSOLIDATED TELEPHONE COMPANY.

To the Editor of The Electrical World:

SIR: Your inquiry of late date received. A uniform standard of wire measurement is of great importance for obvious reasons. We have heretofore used Stubbs' gauge, but have experienced some confusion and annoyance from our country trade, where the differences between the various gauges are little understood, and the means for determining the thousandth of an inch are not at hand. Your efforts to establish a standard will meet the approbation of all wire handlers.

G. F. SHAVER, President.

NEW YORK CITY.

THE BELL TELEPHONE COMPANY OF PHILADELPHIA.

To the Editor of The Electrical World:

SIR: Replying to your interrogatory, we would say that we strongly favor designating the gauge of wire in thousandths of an inch. There is no doubt the best method will be reached in time by all, through natural selection, while legislation must necessarily be based upon what is believed to be best to-day, but which may prove arbitrary to-morrow. SAMUEL M. PLUSH, General Manager.

PHILADELPHIA.

A Question in Electrical Science.

To the Editor of The Electrical World:

SIR: There is a question in electrical science, to which I believe no plain answer is contained in any electrical book. Will you therefore kindly give such an answer in your columns? This is the question:

What is the difference between one current of a given number of ampères, created in a circuit of high resistance by a generator of high electromotive force, and another current of the same number of ampères, created in a circuit of low resistance by a generator of low electromotive force? For example, what is the difference between a current of two ampères, created in a circuit of fifty ohms of resistance, by a generator furnishing a hundred volts of electromotive force, and a current of two ampères, created in a circuit of two ohms of resistance by a generator furnishing four volts of electromotive force? Yours truly. A. H. W.

ANSWER.—Since our correspondent himself correctly proves one to be equal to the other, we need not add anything to enlighten him.—EDS. E. W.

The Kansas City, Mo., Telephone Exchange.

BY D. B. MACQUARRIE.

The Kansas City exchange is the property of the Missouri & Kansas Telephone Company. The present organization bought out the rights and franchises of this territory from the Bell Telephone Company of Missouri in the fall of 1882. The exchange then consisted of 268 subscribers. It was located in a 12 × 14 room on the third floor of the Ford Building, at the corner of Fifth and Delaware streets. In the spring of 1883, the company commenced to reorganize its entire system, and more particularly to rebuild and renew the plant and equipment of the Kansas City exchange. Preparatory to this, the greater part of the fourth floor of what is known as the Wales Building, at the corner of Sixth and Delaware streets, was secured for the general executive offices, where also a room was set apart for the central office, or operating department. Just here, it may be observed, not in a spirit of captious criticism, but as a warning to other companies about to rebuild, the company made its first mistake. This consisted in the location and size of the room reserved for the exchange proper. Every one familiar with the locality knows how narrow both Delaware and Sixth streets are at this point, and how bad the approaches are for a telephone exchange system, on account of the angle in Sixth street and the extreme height of the Wales Building. Owing to the fact that there are only two principal directions from which wires can be brought to this building, it would be impossible to bring more than 1,000 subscribers to such a location by the tower and separate line wire system. But the aërial cable system, which is used exclusively for leading-in purposes, counteracts, in a measure, this otherwise insurmountable objection. It is not necessary that a telephone exchange should, like a telegraph office, be located in a populous part of the city, and on a street directly in the main line of travel. Its patrons and the general public have but seldom any occasion to visit it. The principal considerations for determining the location of an exchange are, first of all, a convenient point in the very centre of its working territory, so as to make all wires diverging therefrom as short as possible; and, in the second place, good approaches for poles and wires, such as wide streets and alleys, and no high intervening houses. Following out these rules would place the Kansas City central office somewhere in the neighborhood of Twelfth and Main streets, or six blocks due south from its present location.

The room reserved for the working exchange is in the extreme east end of the building, facing on Delaware street. It is an oblong room, about 18 × 43 feet, as shown in the accompanying diagram. The first switch-board was put up with its back about three feet from the west wall of the room and facing the windows on the east side; and each additional board added to the right of the preceding one, leaving only one vacant space opposite the door for entrance. This arrangement was all right while the boards were confined to that side only, but when the end of the room was reached and it was found necessary to take a back tack, the trouble began. One board was put up against the north end and the rest continued in rotation with their backs against the east side, thus shutting off the most of the light and the only ventilation in the room. There are now eight boards in position, and one more, or two at the most, would make a complete circle. It will thus be seen that the working capacity of the room is entirely too small for the present number of subscribers, with no provision for the evident increase of the near future. The result will be that the central office will have to be moved within a short time, or the whole floor secured and remodeled for its accommodation. All this was caused by the low estimate which even shrewd business men placed on the telephone business in the early days of the service.

The second mistake, and this was made in common with many other companies throughout the country, consisted in the small capacity given to the outside plant. The instructions given to the foreman in charge of rebuilding were to make calculations for an exchange of about 1,000 subscribers. It was then thought by the management that this provision would be amply adequate for the requirements of the next decade or more. The exchange now numbers 1,500 subscribers, and is growing at the rate of two new ones per day. Were they only in possession of their present experience to guide them when projecting this work, they should have arranged for a carrying capacity of between three and five thousand subscribers. This would have only been on a par with Kansas City's great boom in other branches of trade.

The construction work in itself, as far as its capacity goes, is all that could be desired, and is rated by all who have seen it as A1. The company has been very liberal in its expenditures in this respect, and gave the foreman in charge every facility for doing good and thorough work. It is now reaping the reward of this wise policy by freedom from working interruptions and in cheap maintenance service. The poles are cedar and chestnut, ranging in length from 35 to 60 feet, with a carrying capacity of from a few wires to about 350. They are planted from 5 to 10 feet deep in the ground, and are not less than 35 to the mile. All corners are turned with double poles, one opposite the property line in each direction. All such poles as well as terminal ones, used for cable purposes, are framed with double cross-arms and braces. A strong feature of the construction work is the manner in which all

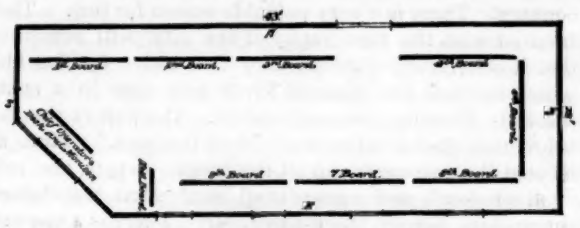


FIG. 1.—DIAGRAM OF KANSAS CITY EXCHANGE.

terminal and angle poles are guyed. The guys are twisted by machinery, and consist of from 4 to 12 strands of No. 8 steel wire, according to the weight and strain of the location. The guy stubs are of large chestnut butts 22 feet in length, planted 11 feet in the ground and standing 11 feet above the surface. These are further secured and kept from bending by a truss rod extending from the top end to a little below the surface of the ground. All guys are provided with a turnbuckle made from ⅝ inch round iron, and having a draw of 2 feet.

As already stated, all wires are brought into the office by the aërial cable system. The kind used is the Patterson low-induction lead-covered cable. The conductors are either 50 or 100 in each. There are already 28 of these in position, aggregating a length of 26,000 feet, and bringing the capacity of the exchange up to 2,200 subscribers. These cables are all strung on the two top cross-arms, next to the pole on each side, and fastened by a cable clip put on every 2 feet, to a No. 2 steel suspension wire. These suspension wires are firmly tied to the cross-arms at each pole, so that should a break occur no strain would reach the cable at any other point except between the two poles where the suspension wire is broken. The cables are protected from abrasion where they pass over each cross-arm by resting on rubber cushions. The wire used for connecting up subscribers is invariably No. 14 steel, and for instrument work No. 18 annunciator cotton-covered copper wire.

The present plant and equipment at the central office consists of 8 switch-boards, accommodating 200 subscribers each, or 1,600 in all, 1 toll board and 1 monitor and chief operator's desk. The system used is the ordinary Western Electric multiple switch-board. Three of these boards are of the old pattern, the cords dropping below the table, and the remaining five are of a later type, the cords being suspended by pulleys from a rack on top of the board. The number of connections that had to be made in setting up these 8 boards is in the neighborhood of 90,000. Fourteen thousand connections were made in setting up the eighth board alone, and the ninth will require 17,200. The last board took the time of 3 men for 5 weeks. There are in all not less than 320 miles of No. 18 annunciator wire in use to connect these boards with their respective cable terminals, and with one another for duplicates. All connections, whether on switch-board, instrument, or main line work, are carefully soldered at this exchange.

The central office instruments are Richards & Gilliland head telephones and Blake's switch-board transmitter. On the toll board Gilliland's long-distance telephone is used.

The manner of making a central office connection is in this form: Subscriber 843 rings his bell. He then takes down the hand telephone and puts it to his ear, waiting a moment. The ringing of his bell drops the shutter of No. 43 annunciator on the 800 board at central office. The falling of this shutter is the signal to the operator that some one is calling her. She immediately inserts a spare plug in spring-jack No. 43 of her board, and says "Hello!" Subscriber 843, on hearing this, says: "Please give me 594." She repeats, to insure him that he has been heard correctly, and that his order has received attention, "594" in a clear, distinct tone of voice, and then inserts the remaining plug, on the same cord, in spring-jack No. 94 of the duplicate block from the 500 board. She next rings up 594 by pushing down on the corresponding knob; and if she has time, is instructed to go in momentarily on the listening strip to ascertain if they are talking, when she leaves them and goes to answering other calls.

Each operator tests all the wires on her own board daily. For this purpose Form 42," is provided:

FORM 42.—OPERATORS TESTING SHEET.

Switch-board.....

Kansas City, Mo., ...188

1	21	41	61	81
2	22	42	62	82
3	23	43	63	83
4	24	44	64	84
5	25	45	65	85
6	26	46	66	86
7	27	47	67	87
8	28	48	68	88
9	29	49	69	89
10	30	50	70	90
11	31	51	71	91
12	32	52	72	92
13	33	53	73	93
14	34	54	74	94
15	35	55	75	95
16	36	56	76	96
17	37	57	77	97
18	38	58	78	98
19	39	59	79	99
20	40	60	80	100

.....*Operator.*

One of these sheets and a lead pencil are distributed to the two end operators on each board at 8 A. M. sharp. Each operator then calls up all her subscribers in rotation as she can find time. Whenever she finds that a certain line is "O. K.," she makes a check-mark through the corresponding number on her testing-sheet. When she cannot raise a subscriber, the number is not checked. In this manner she goes through the entire list. If she has time, she tries again and again all those she failed to raise on the first trial. The sheets are then all numbered, dated and signed, and taken up by the chief operator promptly at 9 o'clock. He then tests carefully for all numbers remaining unchecked on each list, and on ascertaining the nature of the trouble, gives it to the inspectors for removal.

The toll line service diverging from Kansas City is as follows:

Kansas City, to Savannah, Mo., with Leavenworth, Atchison and St. Joseph in circuit, 96 miles, No. 8 steel wire as far as St. Joseph and No. 10 H. D. copper wire between that city and Savannah.

Kansas City to Leavenworth, Kan., a second wire by a different route, 36½ miles, No. 12 H. D. copper wire.

Kansas City to Topeka, Kan., with Eudora and Lawrence in circuit, 67 miles, No. 8 steel wire.

Kansas City to Ottawa, Kan., with Olathe and Paola in circuit, 71 miles, No. 10 H. D. copper wire.

Kansas City to Liberty, Mo., 16½ miles, No. 12 H. D. copper wire.

The charges for this service between Kansas City and any of these outlying points, and *vice versa*, are 25 cents for every conversation of five minutes or fraction thereof. The toll-line service is worked in this manner: The subscriber first gets central office in the usual way. On making known his wishes, the operator on his board connects him with the toll-line board by a trunk line. He now hears the voice of the toll-line operator inquiring

FIG. 2.—EXTERIOR OF KANSAS CITY TELEPHONE EXCHANGE.

what he wants. He replies, giving the name or telephone number and the exchange of the party he desires to talk to. The operator is required to make out a regular ticket, Form 48, for each and every conversation.

FORM 48.

No.....Date..... .....188..
From.....
At .....
To.....
At.....
Charge Tolls.....Cents.
Messenger Service.....Cents.
To .....
Remarks.....
Time.....M. .....Operator

After numbering and dating the ticket, she asks him: "Whom is this to be charged to, please?" He replies, giving the name of the individual or firm renting that particular instrument. The next question is: "Who is this talking, please?" He replies, giving his own name. After noting these replies in their proper place on the ticket, she tells him that she will call him up when she gets the party. She now disconnects him for the time being, and informs the operator at the distant point who and what is wanted. This done, she goes on attending to the calls of others in a similar manner. When the distant operator gets the party wanted, and the line is clear, she so informs the Kansas City operator, who now calls up the subscriber in his regular turn and tells him: "Here is the party you want to talk with at ——." She notes down on the ticket the time of commencing and ending the conversation, and if over 5 minutes and not exceeding 10, she charges 50 cents; if over 10 minutes and not exceeding 15, she charges 75 cents, and so on at that rate of 25 cents for every 5 minutes or fraction thereof. It is also a part of her duty to listen a little and satisfy herself that they are talking, so as to be able to verify the charges on her ticket in case of any dispute afterward. The original ticket is kept on file in the office for checking up with other offices at the end of the month. A duplicate of each is made by the night operator. These duplicates are sent out to the subscribers for collection, by messenger, on the following morning. A great many subscribers simply "O. K." these tickets and return them, when they are kept and sent round for payment at the end of the month; others pay them on presentation, and the ticket is left with them as a receipt. Since this method of collecting by messenger on the following day after service has been adopted, there has scarcely been any loss to the company. If there is at any time a dispute about the time the wire was occupied, or failure to get connection, all the facts and incidents are fresh in the minds of the operator and the subscriber, and they are able to adjust it then and there.

The charges for telephone rental, limited to a radius of three-quarters of a mile from central office, are: For business purposes, $72, and residence, $48 per annum. When the distance is more than three-quarters of a mile, a further charge is made of $6 per annum for each and every additional quarter of a mile, thus: Business, three-quarters of a mile or less, $72; 1 mile, $78; 1¼ miles, $84; 1½ miles, $90, etc. Residence, three-quarters of a mile or less, $48; 1 mile, $54; 1¼ miles, $60; 1½ miles, $66, etc.

These charges are always supposed to be paid quarterly and in advance, and the bills are made out regularly on the first day of each calendar quarter.

The working force of this exchange is as follows: 1 manager, 1 manager's clerk or assistant, 1 trouble man or line repairer, 3 inspectors (1 for overy 500 subscribers), 1 electrician, 1 chief operator (day force), 1 chief operator (night force), 1 assistant chief operator (lady), 24 operators (day force, ladies), 4 operators (night force, young men), 2 messengers, 1 foreman of construction, 10 to 20 linemen.

The scale of wages paid is as follows: Clerk, trouble man, inspectors and chief operators, $55 per month; electrician and foreman of construction, $75; day operators (ladies), $25; night operators, 15 cents per hour; messengers, $20 per month, and linemen, $1.25 per day. The pay roll averages about $2,700 per month.

The inspectors and trouble man have a room adjoining the manager's office. They are provided with a telephone, a desk and trouble report blanks. They are under the instructions of the chief operator, receive all their orders from him, and are required to report to him every half-hour, whether on active duty outside or in their room awaiting orders. The duties of the inspectors are to "O. K." all instrument trouble, and occasionally help the linemen when hard pushed, to take out all instruments discontinued, and *collect all rentals*. For this purpose the whole territory is divided into three divisions, giving each inspector about 500 subscribers. The rental bills when made out are assorted into three piles corresponding to these divisions. The inspectors make the best of collectors. They are daily in and out among their subscribers, and soon learn the financial standing, extent of business and general trustworthiness of the patrons of the exchange. They also get to be quite expert as amateur detectives, and when they have a bill to collect from some one who keeps putting them off from time to time, they keep a very watchful eye on all his movements, and make daily visits to fix up some imaginary trouble in his instrument, for fear he gives them the slip by taking a trip to Canada.

The inspectors are provided with a full set of "relief" instruments, which must always be in their room when not in use. Whenever they meet with continuous or chronic trouble in any subscriber's instrument, they are required to put the relief set in its place temporarily and take it in to the electrician. He cleans and overhauls it thoroughly, renewing any part that may be broken and soldering all connections. It is then tested, when, if found satisfactory, it is returned to the subscriber and the relief instrument taken back to "central." This plan has been found to make a radical improvement in the working of the instruments and the service generally.

The electrician has full charge of the switch-boards and machinery in central office, connecting and setting up all new boards added from time to time, and making numerous experiments with a view to improving the scope and efficiency of the plant. He has also a full set of testing instruments, and whenever any subscriber's line shows symptoms of ground escape, unsoldered connections, etc., he tests it for resistance. Many serious troubles have been located and remedied in this manner.

The average number of calls per day for each subscriber is higher at Kansas City than in any other exchange in the country. There is a very palpable reason for this. Those familiar with the topography of the city will remember that it is naturally divided into two cities by the bluff which starts at the Missouri River and runs in a southwesterly direction toward Rosedale. The part of the city below this bluff is called the "West Bottoms." Here are located the passenger and all the freight depots, the principal wholesale and agricultural implement warehouses, the packing houses, stock-yards, etc. There is a constant interchange of communications going on between these vast interests and the business part of the up-town proper. Hence the frequent use of the telephone. Perhaps another cause is the extreme good nature of the management in permitting so much "deadhead" service, or rather their inability to prevent it The number of calls per day will average 26,000. This is over 1,000 calls to be answered by each operator, and an average of 17½ for each subscriber.

The "moves" in this exchange will average from three to four per day. Whenever a subscriber wants his instruments moved, he notifies the manager. This order is then given to the foreman of construction, who details a suitable force to do the work. Before starting, the subscriber is required to fill in and sign the top part of the blank, Form 50, which is at once an order to move the instrument and a promise to pay for the work when done. When the work is completed, the foreman fills in the time, and signs his name. It is now returned to the manager, who fills in the charges, and sends it out by messenger to the subscriber for collection. The amount charged is generally at the rate of 35 cents per hour for actual time.

It is not claimed that Kansas City has a "model exchange," by any means, nor is this sketch given to the readers of THE ELECTRICAL WORLD with the belief that methods described will be copied and followed. But the management have found that a close attention to the many little details herein enumerated has so greatly improved the service and lessened the number of complaints that they are greatly encouraged to keep on experimenting and improving, and to modestly aspire to the proud ambition of making the Kansas City exchange, its service and its equipment worthy of the rising and progressive city that supports it. The officers of the company and exchange are: J. R. Mulvane, president; C. D. Crandall, secretary and treasurer; W. W. Smith, general superintendent; C. W. McDaniel, superintendent; D. B. Macquarrie, manager, and J. W. Ebert, clerk.

A Great Decision Against the Western Union

The suit of Receiver Farnsworth against the Western Union Company for $2,000,000 for damages inflicted on the Bankers & Merchants' Company by the violent cutting of the wires in July, 1885, was brought to a close on the 10th inst. The summing up for the plaintiff was made by Mr. Conkling, and it was worthy of comparison with the great speech made by Col. Ingersoll in opening the case two months ago. At the outset of his address to the jury, Mr. Conkling characterized the destruction as follows:

"The need and object was to throttle and beat down all opposition in the present and terrify it in the future, so that a giant monopoly which, like a mammoth devil fish, already holds a hemisphere in its iron clutch, may continue and fatten on unchecked exactions wrung from the whole people, and pocketed as dividends on watered stock, chiefly by fewer men than now sit in the jury box. No man, whoever he may be, would have dared such an undertaking in his own name. No man is so independently rich, none so independently insolvent, none so reckless of public opinion and of his own fate as to have the hardihood to present himself without cloak or mask as such a stabber of common right. No name but the name, no power but the power, no cloak but the cloak of a great corporation was panoply and concealment enough against the odium and indignation which would have focused upon and blasted any single individual who openly took such domineering effrontery on himself.

"The fierce competition which has been raging on both sides of the sea since Mr. Mackay and Mr. Bennett dared to lay a cable on the bottom of the Atlantic is matter of public notoriety and history. So is the cutting of rates now going on. To break up rival ocean telegraphing, as it was the necessary effect, so it was part of the purpose and object and plot of the spoliation which took place. These things, in place of shaming or staying, only whetted the ruthlessness of eighty millions of capital and of those who wield it as a highwayman wields a bludgeon. The plan and attempt was to permanently cripple the Bankers & Merchants' system and business and blot it out as a land system, and also as adjunct and feeder of the Commercial Cable to Europe."

Commenting upon the manner of this seizure and the motives that prompted its promoters, Mr. Conkling said again: "The design was to discredit, to humiliate, to destroy—and to do it before the public—to blazon it literally on the housetop, so as to maim and cripple with the widest notoriety and the most lasting and irreparable injury. So, in the very white of the public eye, at the focus of the press and of all the sea-going and land-going telegraph lines in the city of New York, at the most crowded point of the most crowded street, and at the hour when business men leave their offices and move up-town in a procession, and knowing and meaning that through the Associated Press dispatches the event would be announced the next morning in the daily papers from land's end to land's end, the defendants struck. These men had seen, as you have seen, a run on the bank. They knew how like wildfire such a raid goes, and how deep and lastingly it burns. They knew that this property and business, more precarious, unstable and sensitive than a bank, could not in months recover from the injury inflicted in an hour, not even had the property all been surrendered back the next morning. But the design was never to surrender it back, but to involve it in endless lawsuits and contentions which would keep it prostrate and wear out the already depleted bondholders and creditors who owned it. You have seen part of the result. You have heard narrated twelve litigious contests in different courts since, besides this one, and of this one you have seen enough to last you for a lifetime. It has required unusual pluck to cope so far with the Western Union and its enmillioned surroundings, and it has cost in trouble and money a vast sum. Bear in mind that when this deed was done the defendant knew that a sale was to take place which was to yield every farthing ever to come to those who in good faith had bought the stock, bonds and receiver's certificates and advanced money by the hundreds of thousands. Bear in mind that the defendant knew that the property had been appraised to the Court at $4,000,000, and that on that appraisal the Court had acted in ordering receiver's certificates, and that those certificates, under the sanction of the Court, had been sold in open market."

The jury was a long time in arriving at its verdict, but at last gave for the plaintiff to the extent of $240,000. The Western Union lawyers say they will appeal the case, and have obtained a stay of 120 days. The counsel on the other side say that the verdict not only settles the question of title to about 8,000 miles of wire on American Rapid poles, but establishes a precedent for the recovery of damages wherever the wires were cut, the present suit being limited by the Court to local New York trespass.

The Origin of Cyclones.

In a recent paper on the "Conservation of Energy in the Atmosphere," Dr. Werner Siemens gives the following theory of the origin of cyclones. The comparative vacuum formed at the centre of a cyclone can produce suction only in the direction of the axis of the cyclone, thus either raising the water upon the surface over which it rotates, or drawing down air from the higher regions of the atmosphere. The existence of such a descending current of air within a tornado is confirmed by the clear sky and quiet air often observed at its centre. We must imagine, says Dr. Siemens, a local cyclone as produced by an impulse of superheated air, due to some local cause or other, given at the boundaries of an upper and lower tract of disturbance of the neutral equilibrium of an atmosphere at rest, which reaches the boundary of the upper cooled strata of air, which have a tendency to descend. We must thus have an outer descending current formed round the ascending one, by means of which as much air descends as has been carried up by the ascending current. If the disturbance of equilibrium embraces extended upper and lower strata of air, the descending masses will produce an increase of pressure in the neighborhood of the cyclone, gradually extending to the surface of the earth, and on the other hand into the highest regions of the air, and transfer its *vis viva* continually into new superheated masses of air which ascend in the cyclone whilst a part of the descending external cyclone circulating in the same direction, ascends again with the inner, and transfers to it a part of the *vis viva* gained in the higher regions of the air. The course of the centre of the cyclone is then determined by the direction of the mean velocity of all the air masses forming the cyclone, and its duration is that of the disturbance of the neutral equilibrium of the atmospere which called it forth and maintains it. The local ascending current, by carrying dust and particles with it, may also produce rain by condensing the aqueous vapor of the higher strata.

Infringement Suit.—The Bell Telephone Company has filed a bill of complaint, in the United States Circuit Court in this city, against George H. Pride, charging him with infringing the Bell patents in making and selling telephones.

Researches Upon the Self-Induction of an Electric Current.*

BY PROF. D. E. HUGHES, F. R. S.

(*Continued.*)

INFLUENCE OF SELF-INDUCTION ON THE RESISTANCE OF THE CONDUCTOR.

A phenomenon of great importance is the effect which I have observed of the resistance of a wire being greater during the rise of the current, as in the variable period than that measured or known during the constant flow, as in the stable period. By resistance I mean a pure ohmic resistance, a resistance which can only be measured, expressed, or balanced in ohms, and, whatever the cause, the effect is one of pure ohmic resistance.

We can imagine that at the first moment of contact there is no current flowing through the wire; its resistance is then infinite, but the current gradually increases in force until it arrives at its maximum, as in the stable period. We have thus between the moment of contact and period of steady flow a variable period wherein the resistance falls in the form of a curve from infinity to its well-known stable resistance; the telephone is unable to give the exact form of this curve directly, but it gives by the nul method comparative results as to the different duration in time of the curve in different metals.

If we take a straight copper wire 1 metre in length and balance its resistance in the stable period, we shall find only traces of a difference in its resistance in the variable period, and we can balance its self-induction by the induction balance; but if we replace the copper by an iron wire of the same length, or even a much shorter wire, viz., 20 cm., we find that in the variable period we can no longer balance the wire by the induction balance alone, but we must compensate for its increased resistance by the sliding scale, the amount of subtracted German silver wire expressing in fractions of ohms (the value of the wire being already known) the additional resistance of the iron wire in the variable period; we can thus reduce or balance the iron wire to a perfect zero, provided the current from the battery does not exceed 0·10 ampère; but with greater current there will still remain a slight muffled sound, which cannot be reduced to zero either by the induction balance or the resistance slide. It therefore became important to determine if this muffled sound was due to a difference in resistance which could not be balanced, or to the lengthened duration of the extra currents being slower than the balancing current from the induction balance; the latter proved to be the case, for on prolonging the duration of the balancing currents from the induction bridge by introducing a core of iron in its coil, the balance or zero became absolutely perfect. In this case we must choose between cores of different diameter to find one whose reaction on the time effect of the induction coil equals the retardation of the extra currents in the wire tested.

If we observe the method employed in the bridge, we shall see that the induction balance can balance the extra current of the wire *X*, irrespective of the position of the resistance slide *M*, or any relation between the sides *A B* and *A D*. But we cannot equalize the resistance of these sides except by the necessary adjustment of the resistance slide; consequently when we are forced to adjust the induction balance we are compensating the extra current, and when we are forced to move the resistance slide we are balancing resistance.

The disturbance in the bridge caused by the change of resistance of the wire tested in the variable period, causes a momentary primary current to pass through the telephone in the same direction as the extra current, and if these are not separated by balancing the extra current by an induction balance, the mixed effect would be read as a single effect of the extra current. To show the importance of separating these two effects, it is only necessary to say that in most of the cases cited in this paper the momentary primary current due to the extra resistance greatly exceeds that of the extra current; consequently all measurements taken wherein this separation is not complete give the result of a mixed effect.

In the method which I have described, the separation of the extra current from the momentary primary current is so complete that the measures given by the induction balance and resistance slide are invariably the same for a given wire; there is no personal equation, for all observers find precisely the same values both for the resistance and for the extra current.

The method is, however, defective in measuring any small difference of resistance in the variable period in copper wires, as the induction balance itself introduces an additional but opposing resistance by the approaching of its coils, consequently any resistance which we observe is a fraction less than the real amount. To prove this we have only to use a balancing induction current produced from the battery circuit, as shown in my first paper, when we observe this small difference, and, better, observe any small difference of resistance in a straight copper wire, and greater when the wire is formed into a coil.

Soft iron wire gives a far higher resistance in the variable period than hard iron, but each wire, according to its molecular structure, has its own value; the effect increases with the diameter, ranging from 25 per cent. increase of resistance for wires of two mm. in diameter, to 500 per cent. for those of 6 cm.

* Read at the Royal Society, May 27, 1886.

TABLE II.

RESISTANCE OF IRON AND COPPER IN THE STABLE AND VARIABLE PERIODS.

Wires, 1 m. in length, 5 mm. in diameter.	Comparative force of the extra current.	Resistance in ohms, stable period.	Resistance in ohms, variable period.	Percentage of increased resistance in variable period.
Copper.....	78	0.001284	0.001372	7
Soft Swedish iron.....	234	0.008346	0.022200	166
American compound wire, copper exterior, steel interior.....	83	0.002247	0.002696	20
Ditto. steel exterior, copper interior.....	213	0.007750	0 0248000	220

Table II. shows a few illustrative examples: the resistance is given in the fractions of the ohm, indicated by the resistance slide *M*, upon the supplementary resistance wire *H I*.

The table shows that copper and the American compound wire coated with copper have an extremely rapid action or curve from an infinite to its stable resistance, due to their freedom from circular magnetism, whilst iron shows a comparatively slow curve. A remarkable result will be seen where a copper wire has been coated with iron, its variable resistance being 220 per cent. above that of its stable period, and 54 per cent. greater than that of a solid iron wire.

I found in my previous researches that the resistance in the variable period could not be changed by a change in speed of a periodic or tuning fork contact maker, and that the telephone was more sensitive when the rubbing contacts were used without any regard to their frequency of interval. I also found that the telephone was far more sensitive and alone suitable for these experiments when its diaphragm was entirely free from varnish or coating, and sufficiently thick to give a clear musical dominant tone of about C or 512 double vibrations per second, the electro-magnet being also as close as possible without being in actual contact. I noticed that no matter what

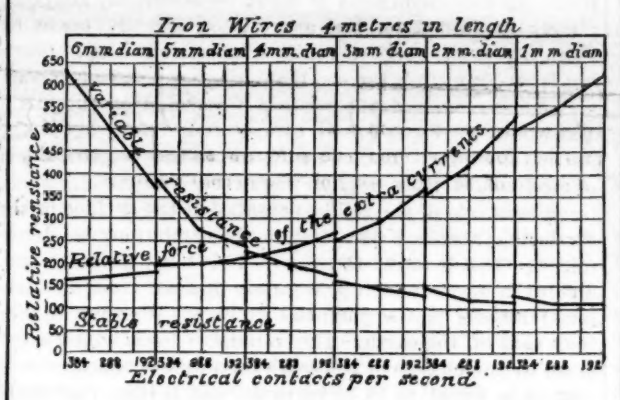


DIAGRAM OF RESULTS WITH IRON WIRE.

number of vibrations were sent, the tones given by the telephone on each side of the zero of the bridge were invariably those of its dominant note. Suspecting that the frequency of vibration of the diaphragm had a direct relation with the resistance found, I altered its note through a range of one octave by employing different thickness of diaphragms, and found that the results were in absolute proportion to the frequency of the vibrations of the diaphragm. The highest tone giving a perfect zero with a high resistance in the variable period, and the low tone giving its zero at a marked less resistance. Thus it was evident that the telephone selected from the mixed vibrations sent by the transmitter those which alone corresponded to its period of vibration, and that we could thus observe the effect of more or less rapid periodic contacts.

The power which vibrating bodies have of selecting from a confused number of vibrations those in accordance with their own, is shown in Helmholtz's resonators, and still more as regards electrical waves, in the remarkable harmonic telegraph of Elisha Gray, who proved that if the armatures of several electro-magnets are made to vibrate, each with a different musical tone or rate of vibration, then we may by the use of a vibrating transmitter of a fixed rate of speed select the electro-magnet alone whose period of vibrations is similar, and that we may send several different periods of vibrations at the same time without any confusion in the receiving magnets, as each electro-magnet selects from the compound vibrations those in accordance with its own. This is exactly what occurs with a telephone when using a periodic contact maker, but I have found in addition that a telephone arranged as I have described will select and respond loudly in its own clear musical dominant tone to a confused mass of rapid contacts such as those produced by a scraping contact, and which in an ordinary telephone gives only the effect of noise of not one-third the power or loudness of that produced by the tone of the musical telephone. We may thus have ten or more telephones of different musical notes, each responding separately in their own tone or all at the same time, as each diaphragm selects its own period from the confused periods of contacts sent by the scraping contact maker.

In order to verify the results, I have used in these experiments both periodic and mixed sound transmitters, but find that owing to the difficulty of keeping the periodic transmitter and telephone in perfect tune with each other, that the mixed sound transmitter is preferable, as it gives no trouble whatever, and we have more accurate results, as we then have only to keep our telephones in accord with the number of vibrations desired.

The experiments mentioned in this paper were all made with a fixed note of vibration of the diaphragm of 512 double vibrations per second. I will, however, mention a few made with varying rates of vibration, and as I propose in a future paper to give a more extended series of observations through a wider range, I will confine myself to these examples.

The diagram shows the results obtained on iron wires of different diameters; their stable and variable resistance were all reduced to comparative values, the stable resistance being taken as 100. Three telephones were employed, the first having the musical note of G, or 768 double vibrations; the second C sharp, or 576 double vibrations, and the third one octave below the first, or G, 384 double vibrations per second.

It will be seen that a great change in the variable resistance takes place in the range of a simple octave, and that the fall from the wires of 6 mm. to that of 1 mm. is so regular as to be almost a continuous curve, and the total curve would be probably that taken by the wire of 6 mm. in its approach to its stable resistance.

If this is the case, as future researches may show, then the resistance of this wire with the comparative slow contact speed of six per second would still have 14 per cent. higher resistance in the variable than in the stable period, or an ordinary Morse telegraph instrument working at a slow speed of only eleven words per minute would experience this additional resistance; consequently, this effect should be easy to prove by the ordinary methods with galvanometers, and this can be accomplished as soon as we have found a method of completely separating the extra current from that due to the increased resistance, as I have already succeeded in doing by the method which I have described.

The iron wire of 6 mm. diameter shows for a speed of 384 contacts per second a comparative resistance in the variable period of 638, or more than six times its stable resistance, but with 192 contacts per second its resistance is but 371; the fall of resistance is so rapid here that for a single octave difference in the telephones, the fall is far greater than the whole stable resistance. The extra current, as well known, is proportional to the length of contact for fine wires, but in large wires the curve indicates that the extra currents have a local reaction on the cessation of the primary current.

(TO BE CONTINUED.)

A Telephonic Police System for New York.

The proposal to give the police of New York a complete telephonic system of its own, at the same time bringing every telephone subscriber into direct communication with police headquarters, is being actively discussed. Vice-President H. S. Huidekoper, of the Metropolitan Telephone and Telegraph Company says, in an interview:

"We want to give the city a good telephone service, and mean to give as good a one as possible, without regard to expense. Such a system as we propose is now in operation in Valparaiso, and it has been found to work satisfactorily there. The expense will be great, and we don't anticipate any profit if it is continued in service for five years at the rate we have been going. We think the system will be of great advantage to the city and the police department in giving protection to property by allowing every citizen who has a telephone instant connection with police headquarters without going out of doors. It will also enable the police to make quick preparations for a mob or any other trouble. The boxes are to be arranged containing complete police apparatus. Each box will be 23 inches high, 12 broad and 8 deep. Whenever an officer is wanted while on his beat, he knows it by seeing a red disc inside of the box against the glass door, which is the call from his station. He can open the doors, one on each side, serving as shields, and talk with headquarters without leaving his beat. We expect to put five boxes on every route, and consequently under ordinary circumstances every officer ought to be reached in a very few minutes. Then, too, it will be found to work in the case of lost children. Now it takes twenty-six hours through the telegraph system to find a lost child. We think it will take only thirty minutes by our system. In case of accidents, all the officer will have to do will be to step to his box and call an ambulance. Every precinct has now under the present law a patrol wagon, and if a policeman has a tough case to dispose of he can telephone for the patrol wagon, put his man in and go on duty again without leaving his beat, while under the present system he might be off his route an hour."

General Superintendent W. H. Eckert said: "When the strikes were going on, New York suddenly woke up to the fact that we have the best police force in the country, and perhaps in the world, but the poorest means of police communication. New York is far behind the world in police communication. The dial telegraph system is played out. The new system will be infinitely quicker

than exchange connection, because it will be given entirely to police matters. An officer at Kingsbridge can connect with any point in the city or in Brooklyn. The telegraph system now used requires an expert to manage it, but any child can use ours. The old system costs $13,000 a year, and we offer ours for $12,000. Officers will not have to leave their beats, except in rare cases, and they can report to their sergeants every thirty minutes."

The only telegraph communication between police stations is through the Central Office. The Metropolitan Company proposes to establish 35 circuits and connect all stations with headquarters. It will also connect 350 street boxes with telephones with the police stations, and if the arrangement proves satisfactory a telephone will be put on each of the 971 patrol posts in the city.

Frightful Injuries by a Lightning Stroke.

A dispatch on the 8th inst. from Leadville, Colorado, says: 'George S. Edwards, who was struck by lightning while crossing Iron Hill on the 4th inst., is slowly recovering. His case is a most remarkable one, and is attracting considerable attention from scientific men. Edwards, after the flash, lay unconscious for fifteen minutes before receiving assistance. The lightning struck him on the left cheek, knocking out a number of his teeth. It then passed diagonally across the breast to the right side, thence to the feet, coming out of the right boot, having passed entirely through the foot, and leaving a hole very similar to that made by a bullet. The clothing was torn into fragments, particles being found at a distance of 200 feet from the spot, while one of the boots, both of which were torn into shreds, was found sixty feet away. Immediately under where the man was standing the ground was torn up for a considerable distance. The lightning's course along the man's body is shown by a black-reddish streak one and a half inches wide, the worst effect being to the lungs, the immediate result being a severe hemorrhage by which a quart of blood was lost.

"In addition to these injuries, the surface of his body is almost completely covered with blisters, the result of severe burns. This is the first authentic record of a person being injured by a stroke of lightning at an altitude of over 10,500 feet, and where a person injured internally as Mr. Edwards was, was not instantly killed."

Bleaching by Electricity.

In the field of electro-chemistry one of the most interesting and ingenious operations of a practical character is that invented and brought to a stage of commercial success by M. Hermite, in which the process of bleaching is carried out by electrolysis. One great advantage claimed for the electric process, says the London *Electrical Review*, is that a saving in cost is effected of about 50 per cent. as compared with the use of bleaching powder; and another is, that it does not involve that danger to the tissues operated upon, which exists in the present process, owing to the presence of lime in the bleaching solution. Under the present system textile materials are not bleached perfectly white, but at a certain stage of the chemical process have to be withdrawn from its influence and perfected by the tedious operation of bleaching on grass. This is rendered unnecessary by M. Hermite's mode of working, the bleaching being completed with the one operation, thus effecting an economy of both time and money. The working of the apparatus is very simple, and by means of an ammeter and voltmeter it can be regulated and controlled at any distance from the bleaching tanks. A solution of chloride of magnesium is submitted to the action of an electric current with an electromotive force of 4 volts through platinum electrodes, causing chlorine to be liberated, and at the same time oxygen from the water, a cycle of changes taking place which result ultimately in the regeneration of the chloride of magnesium. There is, therefore, no practical loss in the chloride of magnesium, and it is due to this fact, together with its low price (£2 per ton as compared with £6 10s. for bleaching powder), that the plan shows such a saving of cost as compared with that generally adopted hitherto.

Power for Electric Stations.

The Jarvis Engineering Company of Boston report they are busy with several orders from electric light and street railway companies for erecting steam plants. They have orders from the following companies: Manchester Electric Light Company, Manchester, N. H. (Weston system), erecting new station, removing two engines and setting two boilers with the Jarvis furnace; Manchester Gas Company, Manchester, N. H. (Thomson-Houston system); Nashua Electric Light Company, Nashua, N. H. (Thomson-Houston system); Armington & Sims Company engine, boiler set with the Jarvis furnace, and using Sheffield grates; Bangor Electric Light and Power Company, enlarging station, new Armington & Sims Company engine; Consolidated Electric Light Company, Portland, Me., new boilers set with the Jarvis furnace; Rutland Electric Light Company, Rutland, Vt. (Thomson-Houston system), Armington & Sims Company engine, two new boilers set with the Jarvis furnace, using Sheffield grates; Edison Illuminating Company, Rochester, N. Y., six boilers set with Jarvis furnace and using Sheffield grates; isolated Edison plant, Armington & Sims Company engine, for Boston Rubber Shoe Company, Malden, Mass.; isolated Edison plant for Massachusetts Hospital Life Insurance Company, two Armington & Sims Co. engines; Newton Electric Railway, Newton, Mass., Armington & Sims Co. engine, boilers set with the Jarvis furnace; Winthrop Electric Railway, Winthrop, Mass., Armington & Sims Co. engine, boiler set with the Jarvis furnace; Charlestown Gas Company, Charlestown, Mass. (Brush system), Armington & Sims Co. engine, boiler set with the Jarvis furnace and Sheffield grates; Vincennes Electric Light Company, Vincennes, Ind. (Thomson-Houston system), boilers set with the Jarvis furnace and Sheffield grates; Mendota Electric Light Company (Thomson-Houston system), boiler set with the Jarvis furnace and Sheffield grates; Owen Sound Electric Light Company, boiler set with the Jarvis furnace; Edison Illuminating Co., Reading, Pa., boilers set with the Jarvis furnace, to burn coal screenings for fuel.

Atmospheric Electricity.

The following is an abstract of a paper by Prof. Franz Exner in the *Philosophical Magazine*. It says: After a critical historical discussion of previous theories, the author communicates the results of his experiments on this subject, which have extended over several years. They refer chiefly to an examination of the electrical field of the earth under *normal* atmospheric conditions. It has appeared that the equipotential surfaces are continually as if the earth had a negative charge. Over a plane the fall of potential is always linear, and its absolute value is constant if the condition of the atmosphere does not change. Such changes are due to the greater or less quantity of aqueous vapor in the air, for this leaves the earth charged with negative electricity. The greatest fall of potential amounts to 600 volts per metre in the complete absence of aqueous vapor, and sinks to below 100 volts in the height of summer. These numbers hold, however, only for continuous fine weather. A measurement of the fall of potential in summer at great heights, by means of air-balloons, has proved that this increases considerably with the height; that is, that aqueous vapor in air is really negative. All the phenomena of negative electricity are completely explained on the assumption already made by Peltier, that the earth contains a negative charge. Starting from Franklin's theory, this charge appears as a necessary consequence of the gradual formation of the earth, and would correspond to an excess of electricity above the normal amount. Bodies which are in the condition last named would thus appear negatively electrified. From the magnitude of the fall of potential at the surface of the earth, the absolute potential of the earth may be determined. This is found to be $= -4.10^9$ volt; that is to say, a point in space which is infinitely distant from all electrical masses has a potential which is 4.10^9 volts higher than that of the earth. The repulsive force which is exerted by the charge of the earth on a square centimetre of surface is equal to 16.10^{-9} grams, and is thus extremely small.

The Hamburg Electric Tramcar Propelled with Accumulators.

There has now entered upon active duty at Hamburg, Germany, a tramcar which obtains its power from accumulators carried by it. Herr Huber, the engineer in charge, was one of the members of the board which awarded the tramcar run by the Julien accumulators at the Antwerp Exhibition, the first prize, in competition with several other forms of locomotors. He is evidently willing to practice what he believes.

The Hamburg car, which will soon be supplemented by others, weighs, fully equipped, 4,830 kgs. Of this weight 1,200 kgs. is that of the accumulators. The accumulator consists of 96 cells, of which every three are united in a single three-cell holder. The cells are formed out of a new material, something like hard gutta percha, but rather more flexible. Each cell contains 10 plates, seven positive and eight negative. The plates have a surface of only 134 by 147 mm, and are about 4 mm. thick. The charging requires about eight hours.

The accumulators are distributed in eight low wooden boxes, of which four are stowed away on each side of the car in the space under the seats. The boxes move along greased slides, and can easily be drawn out by opening two long traps in the side of the car. In the car house the vehicle is drawn between two tables, on which the charging takes place, and the accumulators are slid from the car on to the tables. The shunting of the boxes, both in the car and on the charging table, takes place automatically by a contact apparatus, both simple and sure, constructed by Herr Huber.

Four double conductors lead from the accumulators in the car, which are shunted in four groups, to the Julien commutators, of which one is placed on each platform. By turning a handle which forms part of the key of the commutator, six different positions can be given to it, viz.:

(1) So that there is no connection between the accumulators and the motor. (2) The four groups of accumulators are connected in parallel arc and placed in connection with the motor. (3) The groups are connected two and two in parallel arc, and the two pairs in series and in connection with motor. (4) Two in parallel arc behind the other two in series. (5) All four groups in series. (6) All four groups in parallel arc, but unconnected with the motor. The commutator stands in this position with the key up during the periods of stoppage.

A great advantage of this arrangement is that different velocities are obtained without the application of any current regulator or resistances.

The positions (2), (3), (4), (5) of the key correspond to the E. M. F.'s 48, 96, 144 and 192 volts on the motor, and its velocity again corresponds to these E. M. F.'s. The normal current amounts to about 18 ampères, while on inclines and curves the current may sometimes reach 80 ampères. The motor is a Siemens series machine, model *D*, with about 0.6 ohm resistance. It is hung under the car and transmits its power by means of hemp cords to a loose axle between the two wheel axles, and from hence the power is given out by means of chains to the wheel axles. The hempen ropes are protected as much as possible against the influences of weather by a special preparation.

The reversal of the direction of rotation of the machine is brought about by changing the position of the brushes; there are two pairs of brushes about 90 degrees apart, of which only one pair rubs at one time.

One charging is sufficient to drive the car 50 kilometres. Since such a car has to traverse about 100 kilometres daily, one change of the accumulators is enough.

The Originator of Atlantic Telegraphy.

An article in "Representative Canadians: a Cyclopedia of Canadian Biography," goes to establish pretty conclusively that to Mr. F. N. Gisborne, and to him alone, is due the credit of first suggesting, and, in fact, of originating, trans-Atlantic submarine telegraphy. The Hon. Joseph Howe, in a letter to Mr. Gisborne, dated Feb. 12, 1867, when he was Secretary of State for Canada, says: "Without desiring in the slightest degree to undervalue the services rendered to civilization by the body of eminent men who have just been rewarded for laying the Atlantic cable, I own to some feeling of disappointment in not seeing any mention made of your name, as I have reason to believe you were the first pioneer of the enterprise as well as the original promoter of electric telegraphy in the Maritime Provinces. * * * In 1850 you discussed with me, and subsequently laid before the commissioners, a plan for connecting Newfoundland with the Continent of America, and obtained leave of absence to enable you to go to that island and secure support to the project. * * * On your return you asked leave of absence to go to New York to promote an extension of the line to England, and spoke confidently of being able to extend it across the Atlantic and connect Europe with America. * * * As the original pioneer and projector of this great work, it appears to me that you ought to place yourself in your true position, and that if not included among those who are to be honored and rewarded, you should at least endeavor to obtain from your countrymen and from the world at large, who are to be benefited, the recognition which you deserve as the originator and practical prime mover of the great enterprise now so happily brought, by a combination of public-spirited and able men, to a fortunate consummation." Mr. Gisborne, during the visit to New York, spoken of in the letter, for the first time met Cyrus W. Field, and succeeded in interesting him in the scheme with which the great capitalist afterward became so closely identified.

English Telephone Patents.*

The appeal in the case of the United Telephone Company vs. Bassano and Slater has been heard and dismissed. As our readers will remember, the appeal was made by the defendants from the decision of Mr. Justice North, who held that the instrument made and sold by them possessed the essential elements of the telephone described in Edison's patent of July 30, 1877, those elements being a diaphragm capable of vibrating in response to the sound waves created by the human voice, and tension regulators having the purpose of increasing or diminishing the intensity of the electric current. Edison plainly described a diaphragm of definite form, and indicated its position in his instrument. In the Bassano telephone nothing corresponding to Edison's description and illustration of a diaphragm is to be found; but the tension regulators (which also differ from the tension regulators of Edison) and other portions *were* inclosed within a framework of wood, and for an obvious purpose a mouthpiece, also of wood, was attached to the framework. Now, wood, as well as most other things, as every one knows, is capable of vibration to a certain degree; and this fact the plaintiff company and its advisers seized upon to preserve the monopoly they have secured. The wooden framework and mouthpiece, said they, are diaphragms receiving motion from the air waves, set up by the voice and communicating them to the tension regulators, thus serving the very purpose for which Edison devised his smaller diaphragm. Mr. Justice North held their view to be the correct one, and the defendants appealed against his decision. Lords Jus-

* *London Electrical Review*, July 2, 1886.

tices Cotton, Lindley and Lopes have now confirmed their learned brother's judgment, upon the ground that, according to Lord Justice Fry's definition of the word, viz.: "something which separates something from something else," there is clearly a diaphragm in the defendants' instrument; and secondarily, that tension regulators substantially similar to the tension regulators of Edison were also present.

Upon these grounds it is obvious that it will be perfectly futile for any inventor to hope to devise a telephone transmitter which is to act by the impact of sound waves upon tension regulators, for it will be impossible to bring about this effect without the intervention of a (legal) diaphragm. Messrs. Bassano and Slater state that they can work their telephone while omitting altogether the wooden back alleged to be the diaphragm. The Court declined to say whether the instrument would still be an infringement; but clearly, if Mr. Justice Fry's definition is to be abided by, it would be. For the air itself, the plaintiffs would next contend, is a diaphragm; it intervenes between the speaker's lips and the tension regulators—in other words, is something separating something from something else!

How long are these sophistical definitions to stand? When will a judge throw to the winds the shifting and evasive assertions of partisan scientists, who quibble over gnat-like niceties, and, when it suits their purpose, complacently close their eyes while a whole camel is gulped down? No doubt the learned ones of the bench always seek to give righteous judgments, but in their straining to be scientifically precise they sometimes overlook the claims of common sense.

Electric Lighting for Waltham, Mass.

The directors of the Waltham Gaslight Company have voted, says the Boston *Record* of July 12, to establish an electric lighting plant at a cost of about $20,000. Circulars will be issued to the stockholders calling a meeting for Friday, July 28, for approval of the action, and the purpose is to immediately proceed with the work. Although the bill authorizing gaslight companies to establish electric lighting in connection with its gas failed to pass the Legislature, the directors claim, acting under the advice of excellent counsel, that the existing laws allow of their doing this, provided the stockholders acquiesce. The board consists of Lowell Clark, president; G. A. Stearns, treasurer; A. T. Lyman, J. R. Farnum, J. B. Gooding, directors.

It is claimed they can provide the new light cheaper than an independent company, as it is necessary for them to keep up steam night and day for the steam whistle, and they can economize fuel by using the coke produced in the manufacture of gas. The plant will be located in their present building. What effect this will have on the other proposed company, for which nearly $20,000 subscriptions have already been secured, is not known. It appears likely, however, that the white light will soon be gleaming in Waltham from one or both of these sources. The gas company thinks that its action will head off the other movement; so stated Mr. J. R. Farnum.

Dissatisfied Western Operators on Strike.

The reports of dissatisfaction among operators in the West have been followed by a strike at Omaha. A special dispatch of July 12, from Omaha, says: At 3 o'clock this afternoon a committee of four from the Western Union telegraph operators employed in this city waited on Superintendent Dickey and presented the following:

We, the undersigned, representing the operators employed by the Western Union Telegraph Company in Omaha, respectfully inform you that said operators hereby demand that they be paid full extra wages for all overtime, and that unless said demand is complied with at or before noon, July 13, said operators will refuse longer to continue in the employ of said company.

This action is taken with the sanction of and in concert with the operators employed by the Western Union Telegraph Company at Ogden and San Francisco. At 5:30 the chief operator discharged one of the committeemen, whereupon six other operators walked out; later others quit, making a total of fifteen out of the night force. About twenty of the day force will quit at noon to-morrow if their extra time is not restored. The entire force is about fifty. Telegrams have been received from Ogden saying: "We are with you, and will strike to-morrow." Telegrams of sympathy and support have been received from San Francisco, Kansas City and some points in Texas. The men here are determined, and say they will stand together. They feel sure of winning by the aid of Ogden.

Solid Electrolytes.—At the meeting of the Physical Society, held on June 12, a voltaic cell with a solid electrolyte was exhibited by Mr. Shelford Bidwell. Its construction is as follows: Upon a plate of copper is spread a layer of quite dry precipitated sulphide of copper; if on this a clean plate of silver be placed, and the cell joined up to a galvanometer, a slight deflection is observed, due to the unavoidable presence of moisture. If, however, the silver plate be covered with a slight film of sulphide of silver, by pouring on it a solution of sulphur in bisulphide of carbon, and evaporating the free sulphur by heat, and then placed with the prepared side down as before, a deflection is obtained far greater than, and in the opposite direction to, the former. The resistance of the cell was very great, but was enormously reduced by compression. The E. M. F. was about .07 volt.

The "Hyde" Arc Lamp.

This lamp, which is shown in the accompanying engravings, has been designed in England with the object of simplifying the ordinary clock-work lamps by substituting one wheel of large diameter instead of the train of wheels usually employed.

This friction or brake wheel, Fig. 1, carries a pallet

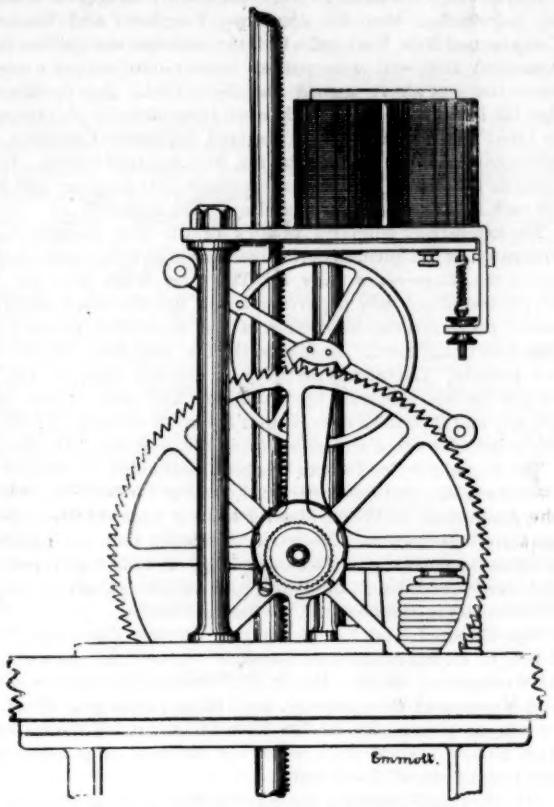


FIG. 1.—THE "HYDE" ARC LAMP.

and its circumference rubs against a brake, which is held down by the light spring shown.

The upper carbon spindle is supplied with a rack gearing in a small pinion on the same shaft as the large wheel, and the whole weight of the rack is tending to drive the pallet forward, but is prevented from doing so by the brake until the current passing through the small shunt coil seen immediately above the brake is of sufficient

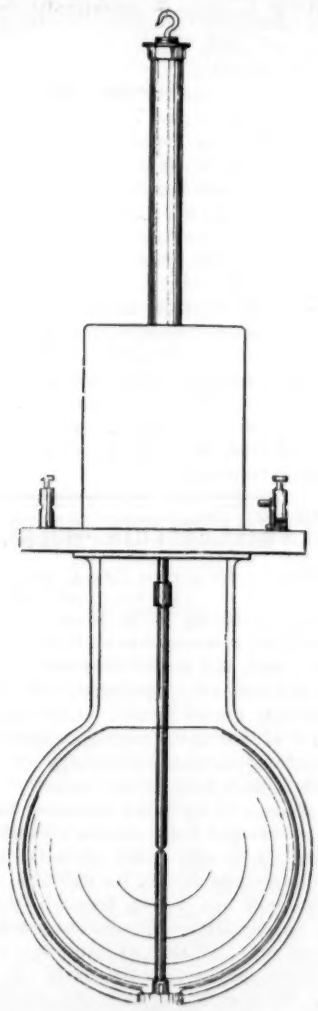


FIG. 2.—THE "HYDE" ARC LAMP.

strength to release the latter when the upper carbon begins to descend. The mechanism of this lamp is thus seen to be very simple, and yet its action is extremely sensitive; when in full work the brake has a trembling movement releasing the pallet one tooth at a time.

The length of arc can be adjusted by simply turning a screw which puts additional pressure on the brake. The large pallet wheel is loose on its shaft, and communicates with the rack through the catch and pinion shown in the engraving. In this way the rack can be raised immediately when required for the insertion of new carbons.

The lamp is started by the small magnet shown in the lower part of Fig. 1, which as soon as the current is turned on raises the carbon and strikes the arc. Fig. 2 shows the general appearance of the lamp; the standard size is 1,500 to 2,000 candle-power, but special lamps are of course constructed for any desired current. It is understood, says the *Mechanical World*, that these lamps are made to burn 18 hours at a stretch with a single pair of carbons without renewal.

The sole makers are Messrs. Stanley & Davies, electrical engineers, Mary street, Hyde.

A Modified Form of Wheatstone's Rheostat.

At a recent meeting of the Physical Society, Mr. Shelford Bidwell read a paper on the above subject. A wire is coiled upon a non-conducting cylinder, as in the ordinary forms of rheostat, one end of the wire being in contact with the brass axle on the cylinder. A screw is cut upon the axle, the pitch being equal to the distance between the consecutive turns of the wire, and this, working in a fixed nut, causes the whole cylinder to travel in the direction of its axis. A fixed spring bears upon the wire at a convenient point and by the traveling motion of the cylinder this point of contact remains fixed in space, and the effect of turning the cylinder is to introduce more or less resistance between the spring and the brass axle. Binding screws on the base of the instrument are in contact with the nut and bearing spring. Though this arrangement has several obvious advantages over the usual forms, Mr. Bidwell does not recommend it in cases where it is required to introduce a known resistance, but where it is important to adjust a resistance to a nicety or to cause a continuous variation it is of great use. Professor Perry, remarking upon the importance of being able to vary a resistance gradually, described an instrument he had used with advantage. A number of plates of gas carbon are placed between two parallel copper plates, one of which is fixed and the other adjustable by a screw; by applying pressure by means of the screw the resistance between the plates can be varied uniformly and regularly from 2 to 10 ohms, beyond which point the increase is very rapid.

Post and Telegraph Business in New Zealand.

Sir Julius Vogel, when speaking at Auckland recently, gave some interesting figures concerning the post and telegraph departments in the colonies, where they are managed by the government, and which made a good comparative showing for the colony of New Zealand, of which he is the Postmaster General. In New Zealand there is a post-office to every 582 persons and a telegraph office to every 1,710 persons; in Victoria a post-office to every 708 and a telegraph office to every 2,147; in New South Wales a post-office to every 848 and a telegraph office to every 2,337; in South Australia a post-office to every 576 and a telegraph office to every 1,742. It will be seen that the accommodation afforded to the public is about the same in New Zealand and South Australia, while it is in excess of that supplied by Victoria and New South Wales. The total annual cost and revenue of these departments is as follows:

Colony.	Expenditure.	Revenue.	Profit or loss.	P.c. of exp. to rev.
New Zealand	£256,000	£284,000	£27,000	90
Victoria	458,000	356,000	101,000	128
New South Wales	538,000	452,000	85,000	118
South Australia	195,000	177,000	18,000	110

It will thus be seen that the colony of New Zealand is the only one that derives any revenue in excess of expenditure for its post and telegraph departments, all the other colonies conducting these departments at a loss. The average annual cost of the permanent post and telegraph offices is: New Zealand, £127; Victoria, £151; New South Wales, £137; South Australia, £145.

Electricity as an Element.

To the Editor of The Electrical World:

SIR: On page 226 of THE ELECTRICAL WORLD for May 15, in a communication headed "Alleged Proofs that Electricity is an Element," Mr. James Johnstone calls attention (section 8) to the fact that while ozone acts with more force than ordinary oxygen, compressed oxygen acts with less. Now, by his own statement "ozone is oxygen existing as a triatomic molecule:" but he seems to have forgotten that the molecules of compressed ordinary oxygen are *biatomic*.

This difference in molecular structure to my mind fully explains the difference between the oxydizing powers of the compressed oxygen and the ozone.

NEW BEDFORD, Mass. FRANCIS HART.

Exploring the Deep.—Jerome Prince, of Milford, is the inventor of an electrical machine for locating articles lost overboard from boats or steamers in deep or shallow water. The model of the machine which Mr. Prince exhibits works perfectly, locating readily iron, steel, gold and silver. The presence of the metal is indicated by rapid revolutions of a compass needle. The machine was given a successful trial at the pond the other day. An iron bar was dropped from a boat, and the bottom of the pond in the vicinity dragged with the plummets attached to the machine, which was carried in the boat. When the plummets struck the bar, it was quickly indicated on the compass. Mr. Prince goes to Boston in a few days to exhibit a model of the machine. He has applied for a patent. The inventor bases his claims on the composition of the plummets and the fact that they will locate gold.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, July 12, 1886.

I find telegraphic matters the prominent theme of conversation this week in electrical circles, next to the report of the subway commission. Some of my friends who ought to be well informed think that the low "cut" rates are not particularly relished by any of the companies, and that, as the starving-out process is uncomfortably slow, it will be dropped for the present, there being instead a public, or even secret, agreement on higher rates than have lately prevailed. Nobody appears to know just which way the cat will jump, but it is expected to jump some way. As to the decision against the Western Union in favor of General Farnsworth, that is generally very satisfactory. I have an idea that even among the Western Union people no great pride is taken in the feat of General Eckert that has brought down another defeat on the monopoly to the tune of a quarter of a million.

It is said regarding the subway commission, that it expects to start a construction company by August; but as the terms of the contract have to be approved by the Attorney-General, it is thought that September may come round before the spade is first driven for the work. And then the various companies that run wires have to be brought to book. However, Mr. Flower, who is a hard worker and enjoys public respect, may be able to smooth away many difficulties.

There is, by the way, a third topic these hot days, and that is the secondary battery. One hears all manner of reports of negotiations and projects and plans, and undoubtedly great activity or ferment prevails in interested quarters. This time, however, something will be accomplished in the way of bringing the accumulator into general use, and we may certainly look for great and early developments in that line as well as in motors. Hardly an inventor or capitalist of my acquaintance in the electrical field but is talking motors, and that, too, quite enthusiastically—and not only talking, but working with energy. More might be said, but I need not anticipate.

The Electrical Supply Company, 17 Dey street, after long and careful experimentation, has produced a new disc battery, to which it has given the name of the Excelsior Disc Battery. The company has made severe tests, and feels very sanguine in introducing this battery to the notice of those interested in telephony and house electric work. Every one using this style of battery would do well to send for a sample. A new gravity drop annunciator also met my eye last week at the company's offices. No springs are used, and a special recommendation is that you can put your annunciator up first and make your wire connections afterward. The designs are all handsome, and the prices are low. I noticed also a new lot of iron box bells of all sizes, the company's own make, and a new line of metal push buttons.

The Splitdorf Insulated Wire Company is ready to guarantee the superiority of its cotton-covered wire over silk wire for magnets. Some of the magnets made with the former wire are used by the long-distance telephone company, and I am told that they are performing their work better than any others similarly employed. Shunt magnets for electric lights, wound with this wire, are likewise reported to give superior service. The low cost alone would make the cotton-covered wire worth a trial.

The manager of a Western Union office in one of the large cities secured a franchise for operating a system of electric time. After investigating systems offered, he decided unhesitatingly to adopt the Carey method of distributing time, as controlled by the Electric Time Company, of 140 Broadway. A letter from him, written after the clocks had been running 60 days, says: "Every one is satisfied that the clocks are all that you claim for them." Over in Brooklyn, the system is working to admiration on the long and tortuous elevated railway, whose vibrating and jarring structure puts clocks to a most exacting trial, out of which no imperfect system could come triumphant. Mr. Carey has certainly got a good thing, slow as he may have been hitherto to let the public know it.

Mr. Charles Schieren, of Charles Schieren & Co., the electric leather belt manufacturers, is in Europe looking after the interests of his firm there. The concern has lately put in some large belts at Paterson, N. J., and is very busy on electric belts at the present time.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., July 12, 1886.

At the plant of the Merchants' Electric Light and Power Company activity is manifest during all hours of the day and night. Orders continue to come in briskly for arc lights for commercial purposes.

Quite a number of Bostonians left New York on the 3d instant on board the Cunard steamer Umbria, and on the 10th instant cable dispatches were in town chronicling the safe arrival of ship and passengers at Liverpool. So much for steam and electricity!

The sad report reached this city on Friday that Mr. Edward R. Swift, of Boston, aged 22, died in Washington, D. C., on the evening of July 8, of congestion of the brain. His family and friends live in Boston and Cambridge. He leaves a young wife, who is at present on a visit to her relatives in Bangor, Me. Mr. Swift was an expert telegraph operator and had followed that business here for the past two years, and was popular with his associates and acquaintances. A large circle of relatives and friends mourn the loss of this talented and estimable young man.

A dispatch from Chicago under date of July 9 says that Judge Blodgett had entered a decree that same day in the case of the American Bell Telephone Company against Frederick W. Baird and Frank Dillon. The court held that the Bell patents of March 7, 1876, and Jan. 30, 1877, were valid, and that the defendants had infringed on the fifth claim of the first and the third, sixth and eighth claims of the last patent. The complainants have waived a right to a master to decide damages. The court assessed a nominal fine of $1, and perpetually enjoined the defendants from further use of the claims set forth.

The Gamewell system of electric fire alarm was successfully tested on Friday, July 9, at Peabody, Mass., in the presence of the chief and board of engineers, the selectmen, the town officers, and a large number of invited guests.

On Wednesday evening, July 7, the Salem aldermen concurred with the Common Council in the adoption of an order appropriating $6,000 for the establishment of an electric fire-alarm system.

Mr. Hubbard, telegraph editor of the New Haven *News*, broke up a fight recently by drawing a pair of scissors which passed for a revolver. Then he had the men arrested, and appeared against them in the Police Court next day, still carrying the same trusty weapon.

Advices received from New Haven, Conn., contain the interesting information that the American Telephone and Telegraph Company, of New York, of which the principal stockholder is the American Bell, will soon put up twenty-four copper wires between the city above named and New York. It is further said that the line will be working between these cities by November 1, and that the Southern New England Telephone Company will have charge of the business in the New England States. Long-distance telephones will cost subscribers $50 per year and a fee for each message, varying according to the distance.

The extensively equipped factory of the Sun Electric Light Company, at Woburn, Mass., came very near being destroyed by fire on the afternoon of July 8. The good work done by Woburn's disciplined fire department and an abundant supply of water prevented the destruction of the wealthiest industries in that flourishing town. As it was, the fire was kept within narrow bounds. The burned property is directly opposite the factory of the Sun Electric Light Company, and only a few yards distant, and it seems a miracle that the latter escaped. The flames fairly lapped its roof and sides during the progress of the fire.

The Signal Service Bureau has been petitioned to remove the Rockland, Me., station where cautionary and weather signals are now displayed, to White Head Point, a rugged and dangerous headland some twelve miles from Rockland, and the outermost point at the entrance of Penobscot Bay. A light and life-saving station are provided at the Point, and a signal station is needed, with telephone communication with Rockland.

The Rhode Island Telephone and Electric Company, Providence, R. I., has moved into new and commodious quarters, No. 54 Westminster street. Mr. R. H. Whittier, Secretary and General Manager of the company, has charge of the new offices, and he will be pleased to receive a call from any of the readers of THE ELECTRICAL WORLD whenever business or pleasure takes them to the city of Providence.

Mr. George W. Adams, the popular Manager and Superintendent of the Boston Electric Protective Association, gave a reception at his residence on July 4 to his scientific and electrical friends. The affair was most harmonious and enjoyable, and Mr. Adams proved himself a "prince of hospitality."

The Edison Company for isolated lighting has just begun the installation of a plant in the mill of the Jackson Company at Nashua, N. H., also one in the factory of the Nashua Manufacturing Company, same town. The above plants will be owned and operated by the Nashua Gas Company.

The Thomson-Houston Electric Company has been awarded the contract for lighting the very large carriage repository of the Messrs. Studebaker Brothers on Michigan avenue, Chicago.

The contract calls for the immediate installation of a plant of fifty 2,000 c.-p. arc-lights, which number will, in all probability, be increased in the autumn.

During the month of June, the Thomson-Houston Electric Company has organized several new electric lighting companies, and has increased the lighting capacity of a number of plants previously installed, among which are the following: A new company at Marion, Ind., to use both arc and incandescent lights; another at Fulton, N. Y., which starts up with generous support from the authorities and business people; a newly-equipped 60 arc-light plant at Memphis, Tenn.; a new company at San Luis Obispo, Cal., and a new company at Miles City, Utah. The Detroit Electric Light Company has had 120 additional arc lights of the Thomson-Houston Company, and an increase of 100 arc lights has been made in the plant at Kansas City, Mo. At Wichita, Kansas, an increase was made recently of 60 arc lights; and at Cleveland, Ohio, 30 arc lights increase. At Nashua, N. H., and Rutland, Vt., the local electric light companies have been recently supplied with 30 and 45 arc lights respectively by the Thomson-Houston Company.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, July 12, 1886.

The new electric lights on North Broad street, from Columbia avenue to Susquehanna avenue, have now been in operation for nearly a month past, and their cheapness is calling attention to the fact that electricity can undoubtedly hold its own against gas, and give better light for less money. Councils originally made an appropriation of $2,000, at the request of Superintendent Walker, to make a test of underground electric-light wires. It was decided to erect a lamp at each street corner, but, after the work had been begun, three citizens, living in the middle of the squares between Susquehanna avenue and Berks street, submitted a proposition to Mr. Walker that, if the city would erect the poles in the middle of the block, they would pay for the lighting. This was accepted, and there are now ten lights between the streets named. These afford a brilliant illumination, and the fact that private citizens are willing to pay for electric lights to light the public streets speaks well for the popularity of electricity. Then, as to the cost: When bids were asked for lighting this thoroughfare, the lowest price named was 75 cents per night, while the cost now is 50 cents. At this rate the cost of the plant will be met in three years. Another illustration of the superiority of the electric light over even the most modern improved gas light, has been afforded lately by a discussion over the location of some improved gas lamps at Dock street market, and it seems clear that electric lamps are very much cheaper than Siemens gas lamps. According to the figures given, eight Siemens lamps burning fifty feet of gas per hour would cost for a night of ten hours at $1.70 per thousand cubic feet, $6.80 per night. Four electric lamps, it is estimated, would give equivalent illumination at a cost of $2.20 per night. If as many electric lights as gas lamps were to be used, there would still be a saving by the use of electricity of $2.40 per night, or 30 cents per lamp.

On the other hand, the Siemens Lungren Company claims that its lamps give an illumination photometrically equal to that of an arc lamp, and that they burn 32 feet and not 50 feet each per hour. Even this showing places the rival lights only on an equal footing—that is, admitting that the gas-light is equal in illuminating power to the electric light. The calculation can be easily made: A Siemens lamp burning for ten hours 32 feet of gas per hour (the Siemens' own estimate), with the price of gas at $1.70 per thousand feet, and an electric lamp burning at a stipulated price of 55 cents per night; the advantage is decidedly with the electric light, as the brilliant appearance of Chestnut, Broad and other Philadelphia streets bears evidence nightly.

While speaking of this subterranean system of electric lighting on Broad street, I ought to say that, besides the electric light wires, there are buried in this conduit other wires, making a total of eight miles of wire in the underground box. These will be eventually used for other purposes by the Electrical Department. The experiment of one month has been so satisfactory that a committee of City Councils has decided in favor of extending the underground electric light wires on North Broad street, from the Reading railroad to Lehigh avenue, and thence to the Twenty-second District Police Station, at Lehigh and Park avenues; also in favor of locating an electric light at Broad street and Lehigh avenue.

The same committee, last week, made a negative report upon the resolution to permit the Postal Telegraph Cable Company to lay underground wires, as it was decided that an ordinance was necessary to grant the permission.

In Councils, ordinances were passed granting the Electro-Pneumatic Transit Company the privilege of placing pneumatic tubes under certain streets, and regulating the laying and construction of underground wires, electrical conductors, conduits, cables and tubes in the city limits.

Last week "Tom" O'Reilly, of your city, was here to see T. V. Powderly and the General Executive Board of the Knights of Labor. He was duly appointed "General Organizer" to enroll telegraphers into District Assembly 45, K. of L. It is said that for this service he will receive from the Knights a salary of $1,000 per annum and his expenses, and that he will visit every town in the United States.

At Harrisburg last week the Westmoreland Telephone Company of Greenburg was chartered, with a capital stock of $10,000. The line will embrace the counties of Westmoreland, Fayette, Allegheny, Armstrong, Indiana and Cambria, and connect the principal cities in that district.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, July 10, 1886.

In company with Manager Stiles I went to Pullman this week to witness a test of the first of the motor cars which are to be used on the Van Depoele electric street railway at Appleton, Wis. There are five of these cars being built, and the first of the lot is just finished. The other four will be ready next week, when all will be shipped.

The test was entirely successful, and was witnessed by Mr. A. Twyman, engineer for the Pullman Palace Car Company, and several other of the Pullman officials, all of whom were highly pleased with the working of the motor car. The car was an open one, and the motor was placed clear ahead on the front platform. The whole car is therefore left for the accommodation of passengers and there is plenty of room left on the front platform for the driver. The motor, in fact, takes up very little room, and its presence on the car, where it is placed forward this way, causes no inconvenience whatever. The power is conveyed to the car wheels by a simple gear arrangement, only the front axle being acted upon. Several trips were made, and, though the rails were rusty and long unused, and the overhead wire at the side of instead of above the track, there was not a hitch of any kind, and the trial was perfectly satisfactory.

The open car, on which the test was made that day, will require a conductor in addition to the motor man, but the other four cars are closed-cars of the regular bob-tailed pattern, fitted with cash-boxes, and they will be run without conductors. It will be seen, therefore, inasmuch as water-power is to be employed, that Appleton is to have a very economical street-car service.

It is impossible to come to but one conclusion after seeing the satisfactory tests and practical work of the Van Depoele motor, and that is, that the electric motor has a future before it, the magnitude of which is as yet but little comprehended.

The whereabouts of Manager Roberts, of the Pacific Mutual Telegraph Company, Kansas City, Mo., are at present unknown to his friends.

Mr. C. A. Brown, of the Western Electric Company, is East. Also Mr. D. H. Dorsett, of the Dorsett Underground Conduit Company.

Mr. Wm. Hubbard, of Elgin, Ill., was a caller at this office this week.

W. A. K.

THE TELEGRAPH.

The Tucker System of electric communication between conductor and engineer is now in service on the Shore Line express from Boston at 11 P. M. for New York.

T. M. B. A.—An agency of this association has just been established at Austin Texas, with Mr. W. A. Pillow, who is an old and well known telegrapher, in charge.

The French Cable Company denies that it is in "a deplorable condition." It is true that the receipts last year did not pay expenses, but out of the balance from 1884 the company was able to pay a dividend of 5 francs per share after deducting the reserve called for by law.

Malicious Wire Cutting.—The wires of the Commercial Telegram Company's tickers were maliciously cut in this city on July 7. Mr. J. Anderson, President of the company, has offered a reward of $1,000 for information as to the wire-cutter. For a short time service to about 200 tickers was interrupted.

Massachusetts Legislation.—The weekly payment of wages law, that went into effect July 1, includes in its operation telegraph and telephone companies. One of the new acts provides that in factories, etc., where steam is used, each room must if required by the inspectors, be connected with the engine room by electric bells or some other means of communication.

Welcome B. & O.!—A dispatch from Findlay, O., says: The extension of the Baltimore and Ohio telegraph line was com-

pleted to this city to-day. The citizens gave the construction force a hearty welcome. The rapidly increasing commercial importance of Findlay, caused by the discovery of natural gas and petroleum, has made additional telegraphic facilities indispensable.

The First Mortgage Prevails—In the suit of the Farmers' Loan and Trust Company, as trustees, to foreclose a three-hundred thousand dollar mortgage on the New York and Washington lines of the Bankers and Merchants' Telegraph Company, Judge Lawrence decided on July 10 in favor of the trustees as against the defense interposed by the United Lines company which set up a claim under a junior mortgage.

Great Western.—A final decree was entered at Chicago on July 10, by Judge Taley in the case of Jeremiah Terwilliger against the Great Western Telegraph Company and its stockholders, finding that its outstanding indebtedness is $375,000, and that its assets have all been exhausted except the liability of its stockholders; that there are about 2,000 stockholders residing in 12 different States, some of whom have only paid 40 per cent. of the par value of their stock, and that an assessment of 35 per cent. is necessary to meet the outstanding indebtedness. The Receiver, E. R. Bowen, is authorized to collect this amount from each stockholder, peaceably if he can, forcibly, by suit, if he cannot.

Telegraph Poles.—Mr. Greenhill, in a paper on "Creosoting," read before the Institution of Civil Engineers, Ireland, gives the following information as to the system for the preservation of telegraph poles for government. Creosoting is universally adopted, all other systems having fallen into disuse. It is reported that, to obtain the specified quantity of ten pounds of creosote injected per cubic foot, the fine skin which grows upon the pole just underneath the bark must be carefully removed by planing. Native larch and other timber is reported to have failed, and no other timber but Baltic redwood well seasoned and then creosoted is used. All the sundry processes for the treatment of timber with salts of zinc, copper and mercury seem to have fallen into disuse owing to the corrosion of the receiver and apparatus by the materials employed, a defect not possessed by creosote, and also to the solubility in water. Oil paint in many cases, when used out of doors, conceals rather than prevents decay.

A Key Infringement Suit.—George W. La Rue, by his attorneys, Briesen & Steel, has obtained a temporary injunction from Judge Addison Brown, in the United States Circuit Court, against the Western Electric Company. The suit was brought on an assignment of the patent granted to Edgar A. Edwards, on January 16, 1883, for an improvement on the Morse telegraph key, consisting in substituting for the trunnions or pivots upon which the lever vibrates a torsional spring or strip of metal. The patent claims the invention of a "contraction in a telegraph key of the lever fulcrumed upon the torsional spring, with the adjusting screws for regulating the amplitude of the lever movement and the retractile reaction of the torsion spring." The defense was that the torsion spring was used on the "sounders" at the end of the line where the message is received, and that a sounder is not a telegraph key such as is referred to in the application for the patent. Judge Brown decided that the use of the spring in the sounders is an infringement on the Edwards patent, and granted a temporary injunction.

THE TELEPHONE.

Erie.—At the meeting of the directors last week, the ½ per cent. dividend was declared.

St. Louis Quotations.—A St. Louis banking circular, bearing date of June 25, quotes Pan-Electric Telephone stock at 4 bid, 5 asked, par being 50, and Bell Telephone stock of Missouri, paying 3 per cent. quarterly dividends, at 130 bid, 150 asked, on the basis of par at 100.

"Rogers and We are Out."—Process has been served at the instance of Mr. J. H. Rogers against his old associates in his equity suit to dissolve the Pan-Electric partnership, and to have account made of sales of State rights. The process would have been served earlier, but the marshal declined to exert himself until his fees were paid.

Barbaric Deeds in Indiana.—A dispatch of July 8 from Evansville, Ind., says: At the meeting of the Council, on Tuesday, an order was issued to the Cumberland Telephone Company to file notice with the city clerk that they would comply with the contract to supply both night and day service, and to raise their wires to contract heights. The company failed to take any notice of this order, and at noon to-day a force of men, under direction of the chief of police and chief of the fire department, proceeded to remove the poles and wires. Other cities in the State are following the example of the Council of Evansville.

Bulling the Stock.—An anonymous circular, dated in June and headed "Bell telephone," was sent to banking houses through the mail to-day, says the Boston *Herald* of July 7. It contains a bullish statement of facts and more bullish conjectures regarding the future. Interesting points are that the bill limiting the holdings of the parent company in subsidiary companies to 30 per cent. will amount to nothing, because it can be evaded; that the company will earn fully 20 per cent. on its stock this year; that the trunk line telephone company's stock may be made large enough to absorb the American Bell stock; that the Bell Company and Western Union will consolidate, and a grand monopoly will result. The author of this statement is an optimist, but if he is honest, he need not be ashamed to sign his name to it.

THE ELECTRIC LIGHT.

Medford, Mass., is likely to have a plant. Mr. T. M. Pierce is interested.

Birmingham, Conn.—The electric light company will make improvements in its station.

The Bristol, Conn., Electric Light Company will erect a new building in which to install its plant.

Mobile, Ala.—The light is in such demand that the plant of the local company is to be enlarged.

Winsted, Conn., is to be lighted with electricity by the local gas company. Twenty-four arc lights go into use to begin with.

Poughkeepsie, N. Y.—The Thomson-Houston plant has been reinforced by two New York Safety Steam-power engines for new circuits.

The King Electric Light Company of Chicago is announced, with a capital stock of $20,000. The incorporators are E. C. King, E. A. Brain and R. H. Byers.

Shohola Glen.—The Fort Wayne Jenney Company has installed an arc plant at Shohola Glen, the beautiful summer resort on the Erie Railway. The "Glen" is illuminated most beautifully, the light adding not a little to its wonderful picturesqueness.

United States Company.—Mr. Weston's contract with the United States Electric Lighting Company having expired, the company has made a new contract with him, by which he becomes consulting electrician of the company. He will conduct his experimental work in his new laboratory.

Kansas City.—The Sperry Associate Electric Light Company reports the installation of the first portion of its large Sperry plant. Apparatus for sixty 2,000 c. p. lamps has already been shipped from Chicago, and as much more will soon go forward. A large Buckeye engine has been taken and will probably soon be duplicated. The company is strongly backed, and expects to do a large business.

Patti and the Electric Light.—Craig-y-Nos Castle, the residence of Madame Nicolini—better known as Madame Patti—is lighted by the electric light. A gas engine of six horse-power is used for driving the dynamo generating the current. The castle is lighted by about 150 Swan lamps, most of the rooms, except the bed rooms, being so lighted. Besides the electric light, a small gas works is connected with the castle, supplying the gas required for cooking purposes.

Opera-House, Paris.—A contract for ten years has been made to light the great Opera-house with 6,000 Edison lamps of 16 c. p., for $45,000 a year. It has been found that gas ruins the fine decorations irretrievably, besides being extremely hot and unhealthy; and thus all the illumination will now be done by electricity. The electric lights heretofore in use were run by gas engines, but to meet the new requirements the whole prime power plant will consist of steam engines.

APPLICATIONS OF POWER.

The Electro-Mechanical Manufacturing Company, of Chicago, has been incorporated with a capital stock of $200,000.

Kansas City.—The incorporation is announced of the Kansas City Electric Railway Company, by W. W. Kendall and others, with a capital stock of $10,000.

Chicago, Ill.—The Chicago Electric Elevator Railway, Chicago, Ill., has been incorporated. Capital stock, $5,000,000. E. B. Payne, Enos Slosson, 128 South Clark street, and A. B. Graham are the incorporators.

Blackpool Electric Tramway.—The audit of the books shows, for the half-year ending with May, that the working expenses are only half that of horses on the most economically worked lines, even allowing 10 per cent. for interest on capital and 15 per cent. for depreciation, because all the generating plant is duplicated. If the electrical working of the Blackpool tramway be compared with the working by horses before the electrical plant was ready, it will be found to cost only 25 per cent. of the latter.

French Prize Competition.—Among the subjects put down for the prize competition for the year 1887 by the Société d'Encouragement we note the following, says the London *Electrician*, which are of peculiar interest to those of our readers who are of an inventive turn of mind: A prize of 2,000 francs for a small motor designed for a family workshop, to be worked separately or to be connected with a central factory. A prize of 3,000 francs for a medium of transporting to a considerable distance natural mechanical powers which their actual position does not allow of being immediately utilized. A prize of 3,000 francs for the invention of a simple and substantial appliance capable of indicating automatically in a sure and regular manner at a given distance the speed of a railway train. A prize of 3,000 francs for the construction of an instrument for transmitting to a distance an indication of the temperature of a heated inclosure. A prize of 3,000 francs for the discovery of a perfect process of transmitting to a distance motive power to agricultural machines. Competitors must send in their contributions before the 1st of January next.

PERSONALS.

Miss Cleveland, the President's sister, says: "In the west, man is rejuvenated by contact with the soil, that seems to throb with electricity." Miss Cleveland evidently has heard something about earth currents.

Mr. Alex. P. Wright, for some time past connected with the United States Electric Light Company, and well known as one of the foremost photometric experts, has now associated himself with the Westinghouse Company.

Mr. James F. Gilliland, of the Gilliland Manufacturing Company, is now associated with the Jenney Electric Company, of Indianapolis, as superintendent of the Construction Department. He is the brother of Mr. E. T. Gilliland, with whom he was also connected in business for many years. He is a successful inventor in electrics, is well posted in mechanics, and will, we believe, prove very useful to the company.

Mr. Edward Weston, under his new contract with the United States Electric Lighting Company, will be able to devote his time exclusively to laboratory work. The instruments of precision and other physical and electrical apparatus with which his old laboratory at the factory was equipped have been transferred to a very fine building in Newark, specially erected for their reception and designed to facilitate their use. The new structure occupies the rear portion of the property on which is situated Mr. Weston's handsome High street residence. It is of pressed brick, ornamented by terra cotta trimmings, and is two stories high. Besides suitable motive power, it contains probably the most completely fitted out machine shop of its size in existence. Here the distinguished electrician will, we understand, continue to prosecute his original investigations and the practical applications of their results with his customary vigor.

MISCELLANEOUS NOTES.

Mayhew, Castle & Skinner, Chicago, are establishing a large electroplating plant.

Bishop Gutta-Percha Company.—At the annual meeting of the stockholders of the Bishop Gutta-Percha Company held in this city on the 7th inst., Messrs. Samuel Boardman and H. E. Blith, of New York, and E. I. Anderson, of Chicago, were elected trustees. The trustees elected S. Boardman President and Treasurer; H. E. Blith, Vice-President, and appointed Henry A. Reed Secretary and General Manager.

Standard Underground Cable Company.—The directors and officers of the company are now as follows: George Westinghouse, Jr., President; Richard S. Waring, Vice-President; John H. Dalzell, Treasurer; Mark W. Watson, Robert Pitcairn, O. T. Waring and C. H. Jackson, Secretary. The main office at Pittsburgh is in the Hamilton building. Mr. Wiley is in charge of the New York office.

A Magnetic Tambourine.—A curious application of the magnet is described in a French journal, the subject of it being a clock recently patented in France. In appearance the clock consists of a tambourine, on the parchment head of which is painted a circle of flowers corresponding to the hour signs of ordinary dials. On examination, two bees, one large and the other small, are discovered crawling among the flowers. The small bee runs rapidly from one to the other, completing the circle in an hour; while the large one takes twelve hours to finish the circuit. The parchment membrane is unbroken, and the bees are simply laid upon it; but two magnets, connected with the clock-work inside the tambourine, move just under the membrane, and the insects which are of iron, follow them.

A New Constant Cell.—Mr. H. P. Laurie has devised a voltaic cell which he claims to be worthy of being considered a constant cell. It consists of a cadmium plate and a platinum plate; the exciting solution being of cadmium iodide with free iodine in it. The cadmium plate was, however, revolved in the solution by clockwork at the rate of two or three revolutions per second. The electromotive force of the combination was about 1.076 volts. This is a convenient value for practical purposes, as, it is almost one volt. The movement of the plate appears to keep the electromotive force more constant, although the cell has been supplying a current, than if the plate had been kept still.

Conductivity of Resins.—M. Bartoli has ascertained that the ordinarily perfect insulators of the resin type become more or less good electrical conductors when heated to softness or melting; afterwards their conductivity increases with the temperature. A mixture of guaiacum with naphthaline, the latter a perfect insulator and of the same melting point as guaiacum, conducts much better than the resin alone, being much less viscous. Oxidized or acid constituents in the resin also increase their conductivity. Some always conduct very little, as Canada balsam, copal, mastic and dammar; Chios turpentine, pitch, asphalte, colophonium, are moderately good conductors when soft or melted. Styrax, jalap, scammonin, dragon's blood, amber; the balsams of Peru, Tolu and Copaiba; shellac, laudanum, aloes, myrrh, Venetian turpentine, are good conductors when melted.

SPARKS AND FLASHES.

Run into the Ground.—"John," said an anxious wife, "they tell me you are running your business into the ground. How is it?" "Maria, I am." "John, do you think it pays?" "No, Maria, the lightning-rod business isn't what it used to be."—*Tid-Bits*.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 65, a 65⅛.

Telephone.—Am. Bell, b 201, a 202; Erie, b 28, a 28½; New England, b 38, a 38¼.

The Boston *Herald* of July 11 says: Bell telephone rose on orders to 203, orders mostly from out of town, including Washington and New York. There is no news current to explain the rise, and none is needed. The telephone is now rising in popular favor, and, popular or unpopular, the earnings of the parent company go on increasing and to increase, and subsidiary companies are doing better probably than ever before, or at least since they depended upon earnings instead of sales of stock for dividends. New England telephone rose to 38¼, with Erie at 28 and Mexican at 1⅛. The rentals of the Mexican Telephone Company amount to about $3,500 per month and will soon be increased to $4,000. Expenses do not vary much from $1,500 outside of construction, which consumes about all of the net revenue not applied to the debt. The debt is now merely nominal. The combined salaries of the president, secretary and treasurer have been fixed at $3,000 per year.

Electric Light.—Edison, b 120, a 125.

BUSINESS NOTICES.

Durable Electro-Medical Apparatus.—Don't fail to read the following business letter:

MARYSVILLE, O., June 29, 1886.

Jerome Kidder Mfg. Company, 820 Broadway, New York:

GENTLEMEN: I write to inquire price of No. 1 office electro medical apparatus; also Nos. 2 and 3 visiting machine.

I have used your instrument for 15 years and want no other kind. Very respectfully, W. S. HOYT, M.D.

Dean's Rheumatic Pills

Are a sure cure, a superior remedy, almost infallible; 50c.

HALE'S HONEY, the great cough cure, 25c., 50c. and $1.

GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.

GERMAN CORN REMOVER kills corns and bunions; 25c.

HILL'S HAIR AND WHISKER DYE, black and brown; 50c.

PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED JUNE 29, 1886.

344,343. Incandescent Lamp; 344,344. Electric Illumination; Charles E. Buell, New Haven, Conn. 1. As shown in the cut, he employs two concentric exhausted globes fastened to a common wick containing the conductors. 2. He employs compressed air conveyed in suitably placed pipes and mains from a central or main compressing-station to combined air-motors and electric generators of suitable construction, arranged to supply a number of independent conducting-wires, each containing an electric light of any known form.

344,345, 344,346, 344,347. Converting Heat Energy into Electrical Energy; Willard E. Case, Auburn, N. Y. See illustrated article.

344,351. Telegraph Key and Register; Lucien S. Crandall, Syracuse, N. Y. It is composed of a number of movable arms, means for simultaneously arranging the free ends of said arms according to a predetermined scheme, and means for locking or retaining the same when so arranged.

344,358. Burglar Alarm; Samuel T. Dickens, Joplin, Mo. Relates to and consists of numerous details in mechanical construction.

344,397. Electroplated Fabric; Robert F. Weininger, Newark, N. J. As shown in the cut, it consists in metallic wires passing into the fabric and forming loops on the surface or surfaces to be electroplated, the said wires being of such cross-sectional shape (as circular) that the metallic electro-deposit may form beneath their widest portion and between said portion and the surface of the fabric, and thereby be locked or fastened in place.

344,343. INCANDESCENT LAMP.

344,417. Connecting Clip for Electrical Apparatus; Marmaduke M. M. Slattery, Woburn, Mass., Assignor to the Sun Electric Light Co., of same place. Two clamps are provided for holding the leading-in wires. The novelty consists in details of construction.

344,425. Suspended Conductor; Charles J. Van Depoele, Chicago, Ill. Consists in combining with a conductor supported from below, suspending devices all arranged upon the same side thereof, a contact traveling upon said conductor, and having an arm for connection with the traveling conductor, said arm depending from the side opposite to the supports, and tension devices for keeping taut the straight portions of the conductor, said tension devices being connected to anchorage-connections secured to the conductor, and extending from one side thereof for a curve of one direction, and secured to the same side, but bridging said conductor, when the curve is in the opposite direction, thereby freeing the path of the depending arm.

344,430, 344,467. Signal Apparatus; John C. Wilson, Boston, Mass. The first is assigned to the Municipal Signal Company, Portsmouth, N. H. 1. Consists of the outer box and starting-lever adapted to be operated from the outside of the box with a locking device for the said starting-lever adapted to be operated to unlock the lever by a key inserted from the outside of the box. 2. Consists of an improvement upon patent 288,536, of Nov. 13, 1884.

344,505. Telegraphic Instrument; George W. Stewart, New York, N. Y. He dispenses with the sharpened touch-point or spur and thimble, and substitutes therefor a disc, button, or similar surface, which may be grasped by the thumb and fingers or touched therewith or with any portion of the hand without incurring fatigue or exhausting the sensibility to impressions transmitted through the armature and attached vibratory bar.

344,514. Telephone Transmitter; Emile Berliner, Washington, D. C. Consists in combining a diaphragm, a cell containing finely-divided conducting material having a ring of flexible insulating material fixed thereto upon the edge adjacent to the diaphragm and in contact therewith, and a projection of flexible or elastic material fixed to the cell and in contact with the diaphragm near its centre, as shown in the cut.

344,523. Galvanic Battery; Waldo L. Gates, Assignor to William H. Williams, Orange, N. J., and John H. King, Brooklyn, N. Y. Consists of mechanical details of construction.

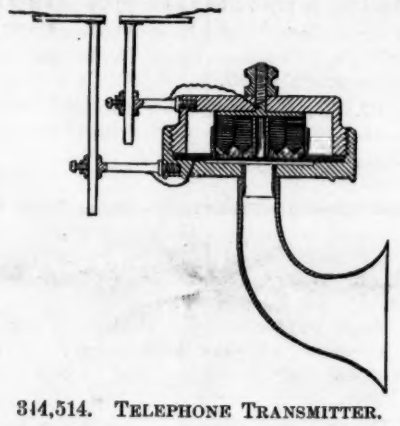
344,542. Dynamo; Charles A. Parsons, Gateshead-on-Tyne, Eng. Includes a central rotating shaft and a removable cylindrical sleeve, which is slipped over said shaft, all combined with dove-tailed rings carried by said sleeve, two or more sets of segments held between said rings and insulated therefrom, and

344,397. ELECTROPLATED FABRIC.

a locking-nut, which secures said rings and segments upon aid sleeve.

344,642, Arc Lamp; 344,643, Motor; Constant Doriot, Philadelphia, Pa. 1. Consists in combining two grooved rollers on separate shafts, two intermeshing wheels on said shafts, a ratchet on one of said shafts, a lever carrying a pawl for said ratchet, and a magnet whose armature is connected to said lever, whereby when said magnet is energized said rollers will be positively turned. 2. Relates first to the construction of the frame, which is made so as to support the magnets and armature, and to afford bearings for a driven shaft separate from but geared with the armature-shaft; second, to the peculiar construction of the brushes, whose fixed ends are coiled, their rubbing ends having boxes which sustain contact or rubbing plates

344,692. Lamp-Holder; Elihu Thomson and E. Wilbur Rice, Jr., Lynn, Mass. Consists in the interposition of the springs between the lamp proper and the tablet or block carrying the pins or other part of the bayonet-joint catch, the socket



344,514. TELEPHONE TRANSMITTER.

being so arranged that the neck proper of the lamp shall rest in it, and shall be held therein firmly, but not rigidly, by the tension of the springs connecting said lamp with the tablet when latter is in position to be engaged and locked in place. The disposition is shown in the cut.

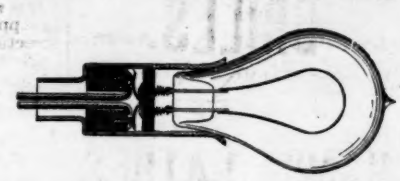
344,679. Motor; Ernest F. Recordon, Paris, France. Embraces magnets placed in pairs and apart from each other and inclined in opposite directions, each magnet of each pair having at its upper edge a lip extending outwardly and toward the other magnet in combination with an armature pivoted to swing between the magnets of each pair, whereby he contrives to equalize the intensity of attraction during the motion of the armatures toward the poles.

344,732. Conduit; Henderson Fondersmith, Philadelphia, Pa., Assignor of one-half to J. Chester Wilson, same place. Consists of a frame and two or more sets of grooved pulleys closely adjacent to each other to form openings for confining as well as supporting the conductors or cables.

344,736. Train Brake; Hermon Hinckley, Williamsport, Pa. Consists of the combination of a friction-wheel, set upon a swinging-lever, and another friction-wheel upon the axle of the car, the two adapted to be brought into contact, cog-gearing for transmitting power from the first friction-wheel to the shaft of cog-wheel, which shaft bears the brake chain, whereby when the first friction-wheel is pressed against the second wheel, which is set rigidly upon the car-axle, the shaft will be turned and the brake-chain tightened, to apply the brakes.

344,750. Battery Zinc; William S. Platt, Waterbury, Conn., Irving G. Platt (Administrator of said William S. Platt, deceased), Assignors to the Platt Bros. Co., same place. It is provided with bars and arms having one or more projections, whereby the electrode is adapted to cells of different diameters.

344,764. Conduit; Arthur T. Woodward, New York, N. Y. It is composed of two or more separate passages placed side by side, rising one above another, and each presenting a side wall



344,692. HOLDER FOR INCANDESCENT LAMP.

constructed for lateral connections to be made with its electric conductor or conductors, and without interference with the electric conductors of the other passages.

344,772. Siphon Recorder; Charles Cuttriss, New York, N. Y. Consists in combining with a receiving electro-magnet, extended pole-pieces for the same, a coil of insulated wire having one side of its convolutions between said pole-pieces, and the other entering a slot formed within one of the pole-pieces, and a recording siphon connected therewith. Described and illustrated in THE ELECTRICAL WORLD, June 29.

344,801. Dynamo. 344,802. Arc Lamp; Wallace E. Freeman, Astoria, New York. 1. It has field-magnet cores each provided with a transverse bar extending to the other core and connected with the latter. 2. Combines a pivoted armature-lever, a carbon-holding rod passing through said lever at its axial line, a rigid support upon the armature-lever, and a clamp-lever depending by a link therefrom at one end, and extending over the armature-lever, with the other end free, which free end is provided with an adjustable screw and jam-nut, and an electro-magnet in circuit with the carbon-holders, the core of which is provided with an adjustable screw-stop, whereby the sensitiveness of the clamp and the movement of armature may be varied at will.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.

George H. Pride, Electrician, Telegraph Engineer and Contractor. 9 Dey Street, New York.

William Marshall, Mfr. of Elec. Condensers. Standards a Specialty. Rooms 2 and 4 University Building, cor. Waverley and University Places, N. Y.

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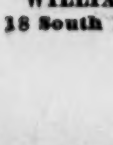

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Assignee's Sale

OF MACHINERY FOR

WORKING RUBBER AND INSULATED WIRE, ETC.

Will be sold at Public Auction, at 12 o'clock noon, on MONDAY, 26th day of July, A. D. 1886, on the premises lately occupied by the Commercial Insulated Wire and Cable Company, at Cranston Print Works, Cranston, Rhode Island—

The Entire Plant and Property of said Company, consisting of a Cruikshank Steam Engine, 50 h. p., with driving pulleys and jack gear, one 18x54 three-roll Calender, three 15x36 grinders or mills, one 15x24 cracker or washer.

The above in complete running order, set with 50 feet 5 inch shafting, couplings, hangers, bearings, etc., etc., connecting the same; 3 Tubing machines, with dies; 1 Pratt & Whitney Wire Coiling machine; 1 No. 72 R. I. Braiding machine; 1 Winding machine; 2 Parry Sifting machines; 1 54-inch steel Vulcanizer, 13 feet long, with track and car; set of Cable machinery, consisting of 1 Cutter, with reels, tables and rolls; 1 Vulcanizer 185 feet long, internal tube 4 inches, external 7 in diameter, with supports, steam pipes, thermometers, etc; complete to operate under Eddy patents; various small machines and tools adapted for use in working Rubber; 1 100-cup Leclanché Battery; 1 Thompson Astatic Reflecting Galvanometer and Battery, complete with shelf; stock and materials on hand, consisting of washed and dried Para Rubber, and other supplies. Patents for machinery for producing Insulated Wire, Rubber Tubing, etc.

The above property will be offered for sale in one lot if a satisfactory bid is made, if not the whole will be at once put up in detail to be sold without reserve. Terms at sale. For further information or view of the property, apply to

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One 1,000 Drop-Multiple Switch-board, new method.
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Will be sold at PUBLIC AUCTION at TWELVE O'CLOCK NOON, JULY 19th, at the office of the

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17 Dey Street, New York.

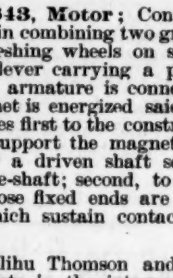
NOTICE.

Sealed proposals will be received at the office of the Board of Trustees of the Toledo Insane Asylum, Room No. 18, St. Clair Building, City of Toledo, Ohio, until August 2, 1886, at 12 o'clock M., for furnishing and putting in place al the machinery and apparatus, including engines, dynamos, lamps, conductors, switches, regulators, and all other fixtures and appliances required for successfully lighting the asylum buildings by incandescent electric light. Parties will accompany their bids with plans and specifications fully setting forth and explaining, in detail, the system of electric lighting proposed to be furnished by them. Drawings and plans of the site and of the several buildings to be lighted can be seen at the office above named.

The Board of Trustees reserve the right to reject any or all bids and waive defects. Appropriation, $18,000.

J. W. NELSON,
President of Board of Trustees.
WALTER PICKENS,
Secretary.

TOLEDO, O., July 2, 1886.



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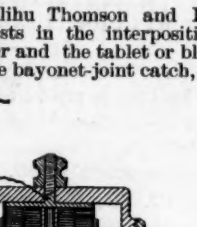

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SPECIAL NOTICE.

National Electric Light Association.

SEMI-ANNUAL MEETING.

The Fourth Meeting—Semi-Annual—of the National Electric Light Association will be held at Detroit, Mich., on Tuesday, Aug. 31 next, at 10 o'clock A. M.

Dues being payable in advance, all members are required to forward the same for the year 1886, by check or otherwise, payable to the order of J. F. Morrison, President, Baltimore, Md.

Electric Light Companies and Manufacturers of Electric Light Apparatus, supplies, etc., desiring to become members must apply on or before Aug. 31 to the President, J. F. Morrison, Baltimore, Md.

Members and others desiring information as to railroad transportation rates will address J. F. Noonan, Esq., Chairman Committee on Transportation, Paterson, N. J.

Special hotel rates will be made known previous to meeting of the Association.

A. J. DE CAMP,
Chairman Executive Committee,
Philadelphia.

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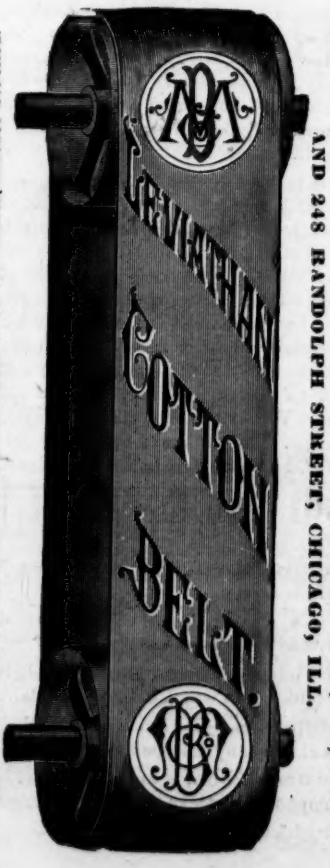

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